

Vol. XV

No. 6

DISSERTATION ABSTRACTS

*A GUIDE TO DISSERTATIONS AND
MONOGRAPHS AVAILABLE IN MICROFORM*

UNIVERSITY MICROFILMS
ANN ARBOR, MICHIGAN: 1955



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AGRICULTURE

AGRICULTURE, GENERAL

SAMPLING AS A TECHNIQUE FOR IMPROVING THE EFFICIENCY OF MARKETING EGGS ON A GRADED BASIS

(Publication No. 12,002)

Paul Chester Clayton, Ph.D.
The Ohio State University, 1954

The objective of this study was to investigate possible sampling methods of buying eggs on a graded basis which would be as accurate as the present method of hand-grading each egg but less costly.

In order to determine the accuracy of the grading process, the variation between graders was tested. In these tests, the graders candled identical samples of eggs which had been previously candled by one or more of the graders being tested. The graders did not know they were being tested.

In the grading of identical samples of eggs there was considerable variation among the graders in the number of eggs placed in each of the various grade classifications. There was also considerable difference between the original grading and the second grading by the same candler. Using the Chi Square method of analysis, the differences between the graders in the grading of identical samples were found to be highly significant. There was a general tendency to upgrade the eggs on the second grading. The differences in monetary values based on the grading of the identical test samples varied from 1¢ to \$2.18 per case (30 dozen). The average difference was 59.9¢ per case.

Seven sampling methods were tested in an attempt to determine the accuracy of the grades of samples as a basis for paying producers for their entire shipment of eggs over a period of one to five weeks. The following methods were tested:

- Method A — Grade of One Case (30 dozen) Sample Every Week
- Method B — Grade of One Case Sample Every Third Week
- Method C — Grade of One Case Sample Every Fourth Week
- Method D — Grade of One Case Sample Every Fifth Week
- Method E — Grade of Entire Shipment Every Third Week
- Method F — Grade of Entire Shipment Every Fourth Week
- Method G — Grade of Entire Shipment Every Fifth Week

The weekly shipments of eggs from a group of producers were used to test these sampling methods over a period of one year. The value per case based

on the grade of the entire shipment and the value per case based on the grade of a one case sample were computed for each shipment for one year from each producer. With these data, the differences between the values based on the grade of the entire shipment and the values based on the grade of the various sampling methods were computed.

These data with the use of the t-test indicated that A, B, and E are satisfactory methods of determining payments to producers with average weekly shipments between 45 and 320 dozen eggs. Over a one-year period the producer would not be overpaid or underpaid if the payments were based on these sampling methods. Methods C, F, and G may also be satisfactory, but further investigation should be made. Method D appeared to be biased. When methods E, F, and G were tested with the smaller shipments (less than 45 dozen), only method E appeared to be satisfactory.

The standard deviation of the differences increased in size as the number of payments based on one sample increased. The average of the standard deviations of the differences for the various sampling methods was no greater than the standard deviation of the differences between graders when candling identical samples. 136 pages. \$1.70. MicA 55-1217

TRENDS IN THE FROZEN FOOD LOCKER INDUSTRY AND UTILIZATION OF LABOR IN SELECTED INDIANA LOCKER PLANTS

(Publication No. 11,626)

William Starbird Farris, Ph.D.
Purdue University, 1955

Major Professor: Clifton B. Cox

The frozen food locker industry consisting of nearly 11,000 plants is faced with the problems of a maturing and changing industry. Locker plants generally have not successfully made the adjustments necessary to meet these changing conditions or the competition of other agencies which provide similar services.

The purposes of this study were to make an economic appraisal of the industry as a whole, to determine labor inputs and outputs for processing meats, and to suggest improvements in the use of labor. Seven Indiana plants with high gross incomes per worker, were selected for the study of labor use.

Recent trends that have been observed in the locker plant industry include (1) a decrease in the total number of plants since 1951, (2) a smaller processing volume in many plants, (3) a smaller percentage of

the lockers rented, (4) lower earnings, and (5) a decline in revenue produced per dollar of labor expense.

Wasted time comprised approximately 10 percent of the work time in the plants studied. A large part of this wasted time resulted directly from too large a crew for the volume of business; however, interruptions, poor schedules, and such factors also contributed to it. Time was frequently wasted at the beginning of the work day and immediately prior to closing time. This wasted time could be reduced by (1) training workers most likely to be idle to do irregular cutting work, (2) scheduling workers to begin work at different times, (3) increasing sales of processed meat, and (4) adjusting crew size to fit the processing volume.

The cutting process required an average of 28 percent of the total time and 31 percent of the productive time of processing workers in the plants studied. The average output of beef quarters for these plants was 1.79 quarters per man hour of cutting time. In plants where the cutting work was performed principally by one person the output was greater than in plants where two or three workers helped with the cutting.

The arrangement of equipment into U-shaped or L-shaped designs reduced walking distance and the manual movement of the product as compared to other arrangements where much crossing and reversing of the product flow were observed. The location of the cutting table near the cooler door appeared to reduce the amount of time required for the cutting process.

Improved methods of blocking beef quarters could be adopted by locker plants with a resultant saving in time for the entire cutting process. The most promising of these methods were blocking the heavy quarters while hanging from the overhead track and blocking relatively light forequarters by the use of the power saw.

The cutting job, which included moving the wholesale cuts to the cutting table, blocking, and dividing into consumer-sized pieces, required an average of 15.8 minutes per quarter. This work made up 47 percent of the time for the entire cutting process in the plants studied. The use of part-time labor and modification of the cutting procedure could reduce the cutting time per quarter. Time saving procedures evolved in cutting beef hindquarters were (1) eliminating movement of the round back to the cutting table when a round steak needs to be trimmed, (2) dividing several round steaks at a time into smaller pieces, and (3) trimming the loin partially with the saw prior to cutting it into steaks. Improvements in the procedure for cutting forequarters were (1) the use of the power saw to pretrim the chine bone of the rib, and (2) the use of the power saw for trimming all steaks and roasts of the forequarter.

The boning job required an average of 15 minutes per quarter of beef in the Indiana plants studied. This amounted to 45 percent of the time used in the cutting process. Possible improvement of the boning procedure might be realized by (1) retaining the trimmings in large pieces, (2) providing sharp knives for trimming work, and (3) using inexperienced workers for boning only when the wage rate will justify it.

The wrapping process required about 25 percent of the time spent in processing beef. For beef quarters weighing 86 pounds, the average time for wrapping was 31 minutes. Improvement of the wrapping process could be realized by (1) orderly arrangement of pieces to be wrapped, (2) measuring and shaping ground beef from a supply on the wrapping table rather than from a deep pan, (3) reducing the frequency of checking the weight of cuts, (4) using pre-cut paper held in a suitable fixture, (5) using both hands simultaneously to close the wrap, and (6) fastening the package with printed labels.

A hypothetical locker plant was synthesized to illustrate the use of labor when many of the labor saving techniques were applied. This plant, operated by a manager, a meat cutter, and a wrapper, could service 600 lockers and 600 home freezers using 2400 beef quarters per year. Equipment was arranged to minimize product travel distance and manual handling. Cutting and wrapping procedures were followed which would allow two workers with a reasonable degree of skill to process 15 quarters of beef per day. The processing crew in this plant could process twice the volume with two workers as that processed by one of the plants studied in which four processing workers were employed.

168 pages. \$2.10. MicA 55-1218

EVALUATION OF SELECTED DEPARTMENTS OF VOCATIONAL AGRICULTURE IN THE NEGRO HIGH SCHOOLS OF VIRGINIA WITH IMPLICATIONS FOR TEACHER- EDUCATION AND SUPERVISION

(Publication No. 12,023)

Marvin Albert Fields, Ph.D.
The Ohio State University, 1954

Adviser: Ralph E. Bender

Since little study has been made up to this time of the extent to which the program of vocational agriculture in the State of Virginia was contributing to the betterment of the individual and society an evaluation of the program was considered both necessary and desirable.

The investigation was undertaken (1) to study the activities of teachers of vocational agriculture, (2) to secure an evaluation of the major aspects of the program, and (3) to recommend programs of pre-service and in-service education for the improvement of the program of vocational agriculture.

Methods and Resources

Evaluative criteria used in the program of vocational agriculture in the state of Ohio were revised and applied to 18 departments of vocational agriculture in the Negro high schools in the state of Virginia. A jury of six individuals approved the criteria, selected the departments of vocational agriculture, and

applied the criteria. The findings were the results of the application of the criteria, conferences with students and other school personnel, and the general knowledge possessed by the committee regarding the program of vocational agriculture.

Findings

Evaluation of the areas of supervised farming, the course of study, New Farmer activities, young farmer instruction, adult farmer instruction, teaching procedures, and the farm shop program was made. The evaluation revealed a range of from 1.46, or "poor," in young farmer instruction to 2.59, or "good," in New Farmer activities with a general average of 1.79, or "fair," for the over-all program.

The committee agreed that the most effective areas of the program were: (1) properly functioning chapters of New Farmers, (2) fairly adequate farm shop instructional programs, (3) operation of an educational program for adult farmers in each of the schools, and (4) the presence of adequate commercially prepared instructional aids. The committee concluded that the following conditions were unfavorable: (1) the absence of young farmer programs in 11 of the 18 departments of vocational agriculture and the ineffective programs in the seven schools which were in operation, (2) failure to base instruction on the problems of students, (3) lack of participation and/or use of local personnel and information, (4) failure to reflect improved techniques in instructional procedures, and (5) little relationship between classroom instruction and on-farm performance of students.

Recommendations

The committee made recommendations for the following: (1) improvement of pre-service training through added laboratory experiences at the observation center, (2) introduction of a graduate course on Supervised Farming, (3) development of a series of workshops and/or small group conferences designed to provide in-service assistance in professional problems for teachers. These recommendations were to be put into operation immediately.

The following features were recommended by the committee as a part of a long-range plan to improve the vocational agricultural program in Virginia: (1) a pre-service training program for teachers of vocational agriculture with increasing emphasis upon laboratory experiences; (2) an expanded program of graduate education for teachers of vocational agriculture which would include a course in Supervised Farming and a course in the Problem Method as applied to the teaching of vocational agriculture; (3) an expanded in-service education program for teachers, directed toward current problems, through the use of conferences and workshops; (4) organization of the teacher-training and supervisory staffs in terms of making the most appropriate use of the abilities of the individual members; (5) a continuing program of evaluation of vocational agriculture, including teacher training and supervision, which would involve teachers

as well as lay people; and (6) further studies of the professional problems of teachers of vocational agriculture, as well as of the use of professional time by these teachers. 246 pages. \$3.08. MicA 55-1219

THE POTENTIALITIES OF IRRIGATION FROM THE NEW YORK STATE BARGE (ERIE) CANAL IN NORTHWESTERN NEW YORK

(Publication No. 11,914)

Levi Mayland Parker, Ph.D.
Cornell University, 1955

Irrigation, although an ancient practice in agriculture is a comparatively recent innovation in the humid East and one beset with problems that often accompany technological change. New York experienced an early interest in irrigation immediately before and after the turn of the century, but it was not sustained. The recent resurgent interest has been stimulated by: a few drier than normal years, high prices, increased command over capital, introduction of crops having more critical moisture requirements, and improvements in irrigation equipment, especially development of aluminum pipe.

The present interest in supplemental irrigation throughout the East is at an all time high. Water resources for irrigation and other uses are in great demand. The inadequacy of water prompted the investigation of irrigation from the Barge Canal.

In determining the potentialities of irrigation from the Barge Canal, the area between Rochester and Lockport and extending north to Lake Ontario was selected as the pilot or study area. This selection was based on a combination of physical, economic, and social factors, which appear more favorable in this area than elsewhere along the canal.

The Physical — The study area lies within the Ontario Lake Plain where the topography is moderately level to slightly undulating. The soils are highly variable lake laid, glacial till, glacial outwash, alluvial, and residual and are considered to be generally productive. The drainage pattern consists of numerous small streams which drain to the northeast into Lake Ontario and could serve as effective distributaries carrying water from the canal to the farms.

The physical factor playing the most important role is climate. Rochester's precipitation records for the last 66 years were analyzed. The analysis of this data indicates that if optimum yields are desired, irrigation would be beneficial at least 5 out of 10 years and possibly as frequent as 8 out of 10.

The Economics — Yields may be increased by providing supplemental moisture, but is there a guarantee that farmers are realizing a greater revenue because they are irrigating? In an effort to answer this question, farmers who are currently irrigating in the area were interviewed. Cost records were obtained from 29 farms. Farmer impressions and reactions toward irrigation were noted. An effort

was made to find specific indicators from their experiences that would substantiate or discredit the merits of irrigation.

There was a great variation in irrigation costs ranging from \$12.00 to \$75.00 an acre (the median was \$25.00 an acre). The results obtained from irrigation varied a great deal from farm to farm and field to field. Most farmers interviewed were enthusiastic concerning results obtained with irrigation, especially those producing high value truck garden crops, and canning and processing crops. The evidence for those irrigating field crops, orchard and pasture indicates promise in some instances, but generally it is not too convincing.

The Social — If irrigation is to expand in the study area, as present signs indicate, certain institutions will have to be altered and new ones will likely evolve to cope with the new innovation. The New York water law dealing with irrigation is antiquated. Organizations will likely be needed to administer the distribution of water. In order to better understand these problems and their possible solutions, the water laws and other irrigation institutions of the West were reviewed in the dissertation. Specific suggestions for institutional arrangements to facilitate irrigation were also made for the study area.

Most of these problems will have to be resolved by those living in the study area. Their success in adjusting to change and innovation may have a marked influence on other irrigation developments in the humid East. 399 pages. \$4.99. MicA 55-1220

PROBLEMS IN MARKETING FLORIST CROPS

(Publication No. 12,286)

Warren Kingsbury Trotter, Ph.D.
Cornell University, 1955

The generally unfavorable market price conditions for florist crops since World War II have resulted from a rapid expansion in flower marketings since the war period and greatly increased production of other consumer goods. These conditions have led to increasing interest in problems relating to efficiency in marketing. The purpose of this study is to identify the inefficiencies in the marketing system for florist crops and the problems relating thereto. The study is designed to provide a framework for further study in various problem areas and to serve as a basis for an expanded research program in the economics of floriculture.

General problem areas covered include: (1) market development, (2) standardization of grades, (3) packs and packing containers, (4) work efficiency in the preparation of crops for market, (5) marketing channels, (6) transportation rates and services, (7) wholesale market location, layout and facilities, (8) wholesale trade practices, (9) market information and (10) trade associations.

The problem of market development stems from the failure of the market for flowers to keep pace

with production. Funerals, weddings, births, and illness account for the great bulk of all flowers sold. The demand for flowers on such occasions has a necessity characteristic which makes such sales particularly attractive to retailers. Retail florists' interest in selling personal services conflicts with the growers' desire to develop home-use demand. Consideration is given to the possibility of expanding the market for flowers through: (1) improved merchandising, (2) development of new outlets and (3) expanded promotional programs.

The lack of standard grades for flowers is a serious obstacle to the development of a more efficient and effective marketing system. Consideration is given to the present status of grading in the industry, the need for grades, problems in establishing them and trade attitudes.

A wide variety of different types, sizes and shapes of shipping containers are used in the industry. There is need for research to develop improved packing methods. Standards for packing would facilitate trading and contribute to increased efficiency.

The process of preparing florist crops for market accounts for a large portion of producers' labor requirements. The development of better plant and shipping room layouts, improved work methods and mechanical aids would all contribute to increased work efficiency.

There has been a tendency in recent years for growers to ship a larger portion of their production direct to retailers. The cost of and returns from direct servicing compared with selling through conventional wholesale outlets is a question of immediate concern.

Increases in express rates in recent years have worked hardships on the industry by restricting the market area and forcing the development of alternative modes of transportation. The problems in this area are of particular concern to growers located far from market.

Increased congestion and inadequate facilities in wholesale markets, credit and delivery policies, accounting and reporting practices, abuses of consignment selling and public relations are major problems in the wholesale trade and offer a fertile field for research to improve efficiency.

A wide diversity of prices exist for florist products of similar qualities within, as well as between, market areas. This situation reflects inefficiencies in the pricing mechanism which are largely the result of inadequate market price and supply information.

The number of trade associations in the florist industry probably exceeds that of any other industry of comparable size. The programs and activities of these groups are examined. Although no attempt is made to evaluate the effectiveness of such programs, it is believed that the analyses of various problems will be helpful in directing the work of these groups towards more productive ends.

293 pages. \$3.54. MicA 55-1221

AGRICULTURE, ANIMAL CULTURE

COMPARATIVE STUDIES ON THE
DETERMINATION OF METABOLIZABLE
AND PRODUCTIVE ENERGY WITH
THE GROWING CHICK

(Publication No. 12,274)

Donald Lindsay Anderson, Ph.D.
Cornell University, 1955

Metabolizable energy and productive (net) energy are probably the most useful measures of feed energy for the growing chick since they take into account the major energy losses. Metabolizable energy measures the total energy of the feed available for all metabolic processes. Productive (net) energy measures the maximum amount of energy available for maintenance and production. The studies reported in this thesis were conducted to determine the metabolizable energy and productive (net) energy values of a complete semipurified ration for the young chick. Having established these values, the methods developed were applied to the determination of the energy value of glucose and cellulose. The results give a basis on which to evaluate the methods of determining these measures of feed energy for the growing chick.

Studies using a pair-feeding technique with small groups were conducted to determine whether pulverized oat hulls or pure cellulose have any effect on diet utilization as measured by growth and dry matter utilization.

In the course of this work it was found that the basal diet was improved for early growth by the addition of oat hulls. This was shown to be due to several marginal deficiencies in the basal diet which were corrected by supplementation with additional protein, unidentified vitamin sources, arginine and trace minerals.

Using the revised basal diet, the data showed that neither pulverized oat hulls nor pure cellulose had any appreciable effect on diet utilization when measured by growth. However, pure cellulose at a level of 30 per cent of the diet depressed apparent dry matter utilization as measured by the chromic oxide indicator method. The presence of oat hulls in the diet had less effect, and in one determination had no influence on utilization of dry matter.

Using regression techniques to combine the data of replicate experiments, the weighted mean productive energy of the revised basal diet was found to be 2.53 Calories per gram. The average metabolizable energy, and its standard error, as found in thirty-one determinations, were 3.34 ± 0.010 Calories per gram of diet.

The values for the productive and metabolizable energy of glucose showed close agreement when determined by two different methods, one based on replacing glucose with cellulose and the other based on deleting glucose from the diet. The productive energy value of glucose was found to be 2.80 Calories per gram, which represents approximately 97 per cent of its gross energy.

The values for productive energy showed considerable variation due to the inherent and procedural errors in the method, the standard error approximating 9 per cent of the mean. In contrast to this the metabolizable energy values showed that this measure was much less subject to these errors and variations. The standard error of the metabolizable energy values in these studies approximated 0.3 per cent of the mean.

Therefore, for practical as well as fundamental purposes, it is concluded that metabolizable energy is preferable to productive energy as the measure for estimating energy values for chicks.

111 pages. \$1.39. MicA 55-1222

SIRE SELECTION WITH AND WITHOUT
PROGENY PERFORMANCE RECORDS

(Publication No. 11,962)

Roy Torgny Berg, Ph.D.
University of Minnesota, 1955

This study was conducted to compare the relative efficiency of selecting sires on the basis of (1) mass selection or individual performance (2) progeny testing and (3) a combination of mass selection and progeny testing.

The data used were obtained from the performance records of the Minnesota No. 1 and the Minnesota No. 2 inbred lines of swine during the period from the time of their establishment through 1954. The performance characters studied were, (1) number of pigs farrowed alive (2) number of pigs alive at weaning, (3) 154 day weight, (4) average daily gain from 56 days to 154 days, (5) conformation score at final weight and, (6) feed consumed per 100 pounds gain in weight.

The method of least squares was used to estimate the performance of the progenies from young sires and of those from reselected sires old enough to have been judged on the basis of a progeny test. In general, the progenies of reselected sires performed slightly better or at least as well as those from young sires but the differences were small and of no practical importance.

Pressure applied in the reselection of sires indicated a change in emphasis away from their own performance.

The conclusion reached was that the use of older reselected sires did not materially alter the general performance level of the lines studied.

Theoretical examination was made of the genetic progress expected from selection (1) of males on the basis of individual performance, (2) between progeny tested males, and (3) on a combination of mass selection and progeny testing. Heritability estimates, because of their importance in the genetic gain concept, were obtained for all traits studied. These estimates obtained from paternal half sib correlations and corrected to the basis of a random breeding population were (1) for number born alive .08 in the Minnesota No. 1 line and negative in the Minnesota No. 2, (2) number weaned .31 and .21, (3) weight at 154 days

.43 and .39, (4) average daily gain .44 and .47, (5) conformation score .52 and zero, and (6) for feed efficiency .12 and .08 in the Minnesota No. 1 and No. 2 lines respectively.

Theoretical selection of sires on the basis of their progenies' performance was usually more accurate for litter size at birth and weaning than mass selection, but this advantage was more than offset by the increased generation interval. For postweaning performance traits measured directly on the sire concerned, the progeny test did not reach the same accuracy in predicting breeding value as was obtained by mass selection. In all the performance traits studied the reselection of progeny tested sires lowered the expected annual genetic gain from that expected with mass selection alone.

Implications of the use of progeny tested sires in livestock other than swine were considered. In general, the accuracy of the progeny test was relatively higher when (1) the heritability of the trait was low, (2) the trait involved was sex limited, and (3) the number of progeny used to estimate a sire's breeding value was high. However, the usefulness of the progeny test of males as a method for the most rapid improvement of production characters in livestock was questioned. The simpler and more economical method of mass selection alone should lead to as much or more improvement for characters with a reasonable degree of heritability. If the heritability is very low, it appears that introduction of new genetic variation from unrelated stock would be preferable to the more costly and difficult method of progeny testing.

General implications of the study on the methodology of forming inbred lines were discussed.

143 pages. \$1.79. MicA 55-1223

EFFECT OF DIETHYLSTILBESTROL IMPLANTATION ON CARCASS COMPOSITION AND THE GROSS WEIGHT OF CERTAIN ENDOCRINE GLANDS OF STEERS AND BULLS

(Publication No. 12,163)

Verne Richard Cahill, Ph.D.
The Ohio State University, 1955

Providing an ample meat supply for our growing population requires planning and great expenditure of effort. It is becoming increasingly imperative that there be devised methods which will facilitate making available to each consumer at least a reasonable quantity of nutritious, palatable meat. This project with beef cattle is concerned directly with efficiency of production, carcass grades, and the improvement of other meat characteristics important to the consumer.

Although some investigation of the role of the endocrine glands in animal growth, fattening, and efficiency of meat production has been accomplished, additional information needs to be sought. This report centers around the effect of diethylstilbestrol

implants on steers and bulls. Production data are considered, but the emphasis is on carcass characteristics and the endocrine glands.

Forty Hereford cattle were allotted to four groups of ten head each. These lots consisted of steers, implanted steers, bulls, and implanted bulls. The subcutaneous implantation in the ear of 84 mg. of pelleted diethylstilbestrol was made at the beginning of the feeding period and again 84 days later.

At the end of the 168-day feeding period the implanted bulls showed an average daily gain of 2.96 pounds as compared with 2.76 pounds for the bulls, 2.79 pounds for the implanted steers, and 2.31 pounds for the steers. Cost per hundred pounds of gain increased except for the low cost of gain established by the untreated bulls. Treatment of steers lowered the carcass grade; treatment of bulls produced carcasses of higher grade.

From the implanted cattle slightly heavier pituitary glands and significantly heavier adrenal glands were obtained. Thyroid glands of the implanted bulls were significantly lighter in weight than the same gland of the untreated bulls, but treatment of steers had little effect on the weight of this gland. Weights of penis and testicles were reduced also in the treated lots.

Other factors discussed in this report are shrinkage from purchase weight to kill weight, dressing percentage, and weight of hide and paunch.

Measurement of the lumbosacral angle gave evidence that treatment made this angle much more acute, a fact which in turn tends to support the raised tailhead observation. In conjunction with this, the pelvic orifice was found to be greater (dorsoventral measurement) in the carcasses of treated animals.

Complete wholesale-cut yield is reported on fifty per cent of the carcasses of each lot. Using the right side of each of these same carcasses, the investigator made a detailed physical separation of edible portion, bone, and excess fat. The per cent of bone was reasonably constant from lot to lot. Implanting of bulls increased the percentage of fat, while the reverse appeared to be true in the case of the steers. In comparison, the 76.07 per cent edible portion found in bull carcasses was lowered to 75.03 per cent in the carcasses of treated bulls. Implantation raised the edible portion from 69.88 per cent in the untreated steers to 71.97 per cent in the treated steers. Measurement of the cross-section area of the longissimus dorsi muscle correlated directly with the data concerning the edible portion. On the basis of the total of 20 sides subjected to the physical separation, the correlation coefficient of area of longissimus dorsi muscle and pounds of edible portion was significant well beyond the 1 per cent level ($r = 0.853$, with 19 degrees of freedom).

A tenderness (test at 3 days post-mortem) is the final analysis reported. Although the bull steaks were acceptably tender, the steer steaks were significantly more tender. Diethylstilbestrol implantation produced no significant difference in tenderness.

77 pages. \$1.00. MicA 55-1224

DIGESTIBILITY AND NUTRITIVE
VALUE OF ALFALFA SILAGE FOR
YOUNG BEEF CATTLE

(Publication No. 11,966)

Ralph Boyd Cathcart, Ph.D.
University of Minnesota, 1955

Adviser: E. F. Ferrin

Three feedlot trials with alfalfa silage in the winter rations of beef calves were conducted. An additional group of cattle was fed alfalfa hay from the same field and cutting in the second and third trials. Three digestion studies were also conducted. Nine steers were used in each of the digestion trials.

Neither wilted nor non-wilted alfalfa silage (made with no preservative) produced satisfactory winter gains when fed as the only feed during the first two feedlot trials. In the second trial the lot fed alfalfa hay as the roughage made satisfactory gains, namely, 1.24 pounds per head daily.

In the third feedlot trial four lots of calves were fed 4.0 pounds of concentrates per head daily the last 84 days of the 113-day feeding period. The dry matter intakes among lots were kept as equal as possible. One lot of calves was fed silage prepared with 150 pounds of corn meal per ton of fresh forage.

The average daily gains per head were as follows: Corn meal-alfalfa silage plus corn, 1.17 pounds; alfalfa silage plus corn, 1.15 pounds; alfalfa silage plus corn, 3.0 pounds, and cottonseed meal, 1.0 pound, 1.23 pounds; and, alfalfa hay plus corn, 1.52 pounds. The gains of the cattle on the alfalfa hay were statistically significant at the 5 per cent level.

Dry matter requirements per 100 pounds of gain were as follows: Corn meal-alfalfa silage, 836.75 pounds; alfalfa silage plus corn, 842.61 pounds; alfalfa silage plus corn and cottonseed meal, 790.43 pounds; and, alfalfa hay, 619.74 pounds.

In the first digestion trial the coefficients of digestibility in alfalfa hay for dry matter, crude protein, nitrogen-free extract and the total digestible nutrients were statistically superior to those in alfalfa silage. The coefficient for ether extract was statistically significant in alfalfa silage over that in alfalfa hay. There was no statistically significant difference in digestibility of crude fiber.

Three steers were fed alfalfa hay at the rate of 12.0 pounds per head daily in comparison to 8.0 pounds. There were no statistically significant differences in digestion coefficients at the two different levels of hay intakes.

In the second digestion study when 4.0 pounds of corn were fed per head daily alfalfa hay was superior statistically to silage in digestibility of dry matter, crude protein, and, in total digestible nutrients. No statistically significant differences were evident between the hay-corn ration and a silage-hay-corn ration except in protein digestion in favor of the former, and, in favor of the latter in crude fiber digestibility.

Two pounds of supplements to alfalfa silage per head daily were tested in the last digestion study.

The concentrates fed were as follows: corn, corn and soybean oil meal, and, soybean oil meal. The soybean oil meal ration was statistically superior to the other rations in the digestion coefficient for protein, but there were no other statistically significant differences present.

In general the results obtained in the two different types of experiments were in agreement in regard to the necessity for the supplementation of alfalfa silage for satisfactory performance in the winter rations for beef calves. 151 pages. \$1.89. MicA 55-1225

BODY COMPOSITION AND DIGESTION
STUDIES WITH SWINE: I. INDIRECT
METHODS OF MEASURING BODY
COMPOSITION. II. USE OF CHROMIUM
OXIDE IN DIGESTION STUDIES

(Publication No. 12,277)

Albert J. Clawson, Ph.D.
Cornell University, 1955

Part I.

Since the first exploratory work on the growth-promoting effect of antibiotics, much additional work has been done on this effect. Several reports have indicated that the feeding of antibiotics to swine may impair the carcass quality by causing an increased deposition of fat.

In this thesis, additional studies on body composition of swine are reported. Examination of body composition data obtained from the literature for 127 pigs varying in weight from 10 to 350 lbs. and in age from 26 to 300 days, reveals that body fat and water on an empty whole animal basis are inversely related ($r = -0.98$). This relationship is shown to be curvilinear and may be expressed by the equation $Y = 178.83 - 0.63x - 66.62 \log x$ with a standard deviation from regression of 1.4 per cent, where y = the percentage of body fat and x = the percentage of moisture in the whole empty body. The deviation from linearity was highly significant. The mean protein and ash contents and their standard deviations in the fat-free, dry body are 83.1 ± 1.6 and 16.9 ± 1.6 per cent, respectively. This information was used to calculate total body composition from body water in the pigs used in the slaughter trials.

A dilution technique employing antipyrine has been shown to be useful, as an indirect method, for predicting body composition. Mean body water values obtained by the antipyrine method and by direct analysis on 29 pigs were 44.4 ± 4.6 and 45.5 ± 4.0 per cent, respectively. Differences in body composition between control and antibiotic-fed pigs were not mathematically significant.

Part II

The use of an inert reference material which can be measured quantitatively in the feed fed to an animal and in the resulting feces has many advantages

for use in predicting digestion coefficients over the conventional total collection method.

Cattle excrete Cr_2O_3 at an uneven rate throughout the day. However, only limited data are available on the excretion pattern of Cr_2O_3 for swine. Indications are that the excretion rate is much less variable for swine than for cattle. The use of digestion studies in conjunction with feeding trials would add a great deal to the information acquired. Therefore, further experiments are needed to determine the adequacy of grab or random sampling of swine feces for the purpose of measuring digestibility.

A seven-day total collection was made from ten lots of eight pigs each. Collection was started at the same time that feed containing chromium oxide was made available in self-feeders. After each 24-hour period the total feces from each lot was weighed, and sampled for moisture and Cr_2O_3 analysis. After a four-day preliminary period grab samples were taken from each pig at 6:00 A.M. and at 5:00 P.M. and compounded by lots for Cr_2O_3 analysis. Individual fecal samples were taken from eight pigs in one lot at 5:30 A.M., 10:30 A.M., 3:30 P.M. and 8:30 P.M. for a four-day period. A period of between three and four days was required for the excretion rate of Cr_2O_3 to equilibrate with intake. A highly significant difference in Cr_2O_3 excretion was noted in fecal samples taken at various times throughout the day. The digestion coefficients obtained for individual pigs self-fed the same ration were significantly different. In spite of marked variation in excretion rate and in digestion coefficients for individual pigs. Analysis of compounded fecal samples representing 6:00 A.M. and 5:00 P.M. collections gave results comparable to those obtained by conventional total collection.

88 pages. \$1.10. MicA 55-1226

PHYSICAL CHANGES IN YOUNG DAIRY HEIFERS AS INDICATED BY TYPE EVALUATION STUDIES

(Publication No. 12,015)

Carl Moore Clifton, Ph.D.
The Ohio State University, 1954

Adviser: Fordyce Ely

The type of 544 Holstein heifers in five herds was scored at 3, 6, and 12 months of age. The score card was divided into ten parts with equal point value as follows: head and neck, shoulders and chest, middle and loin, rump and thighs, feet and legs, size and shape of udder, udder attachments, teats (placement and size), dairy character, and general appearance. The scores used are, in most cases, the average ratings of two judges.

The repeatability of ratings from one age to another in the same heifer was estimated by linear correlation to be between .16 and .37. The comparison between 3 and 12 months of age tended to fall in the lower part of this range and other ages in the upper part. Although the coefficients varied widely

(-.077 to .570) between herds and score card divisions within herds, the herd differences were significant in only two divisions. In total score one herd exhibited no repeatability between 3 months and six months, while the other four herds were uniformly near .4. Herd differences in the repeatability of ratings for "teats" were significant at the 1 per cent level in two age comparisons and at the 5 per cent level in the other.

The analysis of variance was used to test differences between ages. These differences were significant at the 1 per cent level in every score card division. The most notable of these differences were the progressive improvement in shoulders and chest with age, improvement in feet and legs, particularly between 3 and 6 months, and the downward trend in rump and thigh ratings, especially between 6 and 12 months. The other differences are considered less important because of herd differences or because the trends are reversed at different ages.

In four herds two or more sires had at least twenty daughters with ratings. Using the first twenty such daughters of each of these sires, differences between sires in each herd were tested for significance by the t-test and analysis of variance. Significant differences were found in each herd at each age. However, none of the differences found in 3 months old heifers persisted to 12 months of age. Differences were found in each score card division in at least one herd at one age. The most frequent and persistent differences were found in rump and thighs, feet and legs, and the udder divisions.

The general conclusions from this study are as follows. Type ratings made under the conditions of this study have a basic repeatability of about .2 in heifers of these ages, but this repeatability varies considerably in small groups of animals. Characteristic age changes are normal but variations occur in different herds and in different families within herds. Differences between sires may be demonstrated in their 3, 6, and 12 months old daughters, but the permanence of these differences is not known.

74 pages. \$1.00. MicA 55-1227

MORPHOLOGICAL CHANGES IN THE BOVINE ENDOMETRIUM DURING NORMAL CYCLES AND FOLLOWING ATTEMPTS AT SYNCHRONIZATION OF THE ESTROUS CYCLES WITH PROGESTERONE

(Publication No. 11,974)

Philip John Dziuk, Ph.D.
University of Minnesota, 1955

Endometrial biopsies were taken by a specially constructed instrument from six grade Holstein heifers. The biopsy samples were taken every other day throughout at least one normal cycle for each animal and during a cycle which had been altered by daily administration of progesterone. Samples were also taken from an ovariectomized cow, untreated and treated with diethylstilbestrol, progesterone and a

combination of the two. The tissues obtained were examined and evaluated for surface epithelial height, gland epithelium cell to nuclei height ratio, surface epithelium activity, gland activity, amount of nuclear debris in gland lumen, amount of secretion in gland lumen, cell density in upper endometrium and number of mitotic figures in surface or gland epithelium.

One animal which had yielded 21 consecutive biopsy samples was slaughtered 48 hours after the last sample was taken. There was a small non-inflamed wound at the site of the last biopsy but all previous sites had healed so as to be almost indistinguishable from the remainder of the uterus. There was no evidence of abnormal cycle lengths either during or following the biopsy operations.

There are 161 biopsy samples that are considered. It was found in this study that the surface epithelial height was very inconsistent from one sample to another in a series and showed no definite cyclic trend. The activity of the surface epithelium was at a maximum near the seventh through the eleventh days of the estrous cycle. Throughout the remainder of the cycle the activity was variable but tended to be lower.

The activity of the glands was at a minimum at heat and gradually increased to about day twelve of the cycle. Mitotic figures were found only in sections which were taken between day one of the cycle and day twelve.

Nuclear debris was found in the least amounts during the time from the sixth to the eleventh day. Some was found during other times but was somewhat variable.

The amount of secretion found in the glands gradually decreased from heat onward until about the tenth day when it starts to gradually increase.

The cell density in the upper endometrium was highest at heat and shortly afterward and was the lowest between the eighth and twelfth day of the cycle.

There was no detectable day to day change in the endometrium. Changes were very gradual and all factors had to be considered in evaluating a sample. It was possible to estimate the degree of activity by considering all factors but it was not possible to accurately date a given sample.

The ovariectomized animal yielded tissue samples of very thin endometrium, low surface epithelium and generally inactive glands. Neither diethylstilbestrol nor progesterone alone in the doses given had any effect. A slight stimulation of activity was noted following the combined administration.

In 32 cases progesterone in corn oil was injected subcutaneously every day to inhibit heat and ovulation. The dosages ranged from 40 to 60 milligrams per day and the range in the number of days of administration was 4 to 18. In 20 of the 32 cases heat occurred between the third and sixth day following cessation of treatment. In the remainder of the cases the interval was somewhat prolonged. The most consistent and desirable results were obtained with younger animals. 84 pages. \$1.05. MicA 55-1228

STUDIES ON STUNTED CHICKS: THE THYMUS FACTOR AND ITS EFFECT ON GROWTH

(Publication No. 12,186)

Ernest Ross, Ph.D.

The Ohio State University, 1955

METABOLISM OF STUNTED CHICKS

Stunted chicks constitute a problem of considerable economic importance as well as one of general scientific interest. This investigation was designed to study some of the differences between slow-growing (stunted) and rapidly growing chicks, in order to determine some possible nutritional or physiological basis for stunting.

A preliminary experiment was designed to determine whether social order had any influence on the incidence or severity of stunting when chicks were reared in a battery brooder.

The data showed that there were no adverse effects on growth when chicks from 3 to 5 weeks of age were raised in groups of 20 in a battery. All classes of birds grew as well in individual cages as in the battery, a fact which further indicates that the individual cages used in these experiments were comparable to the battery brooders in promoting growth.

In another experiment small, median, and large chicks were selected and placed in individual cages at two weeks of age. Feed consumption, water consumption, and dry weight of the droppings were determined for the individual chicks between 3 and 5 weeks of age.

The results of these experiments showed that although there was no appreciable difference in feed digestion or in water consumption per unit of feed intake between the small and large chicks, the smaller, slower-growing birds had a poorer feed efficiency and tended to have a higher per cent of carcass fat.

STUDIES ON THE THYMUS GROWTH FACTOR

A series of experiments was planned to demonstrate the growth-promoting effect of fresh calf thymus. The basal ration used in all of these experiments consisted of corn and soybean meal supplemented with all of the vitamins and minerals known to be required by chicks.

The thymus-fed chicks gained an average of 4.2 per cent more than the basal-fed chicks, and this increased gain was highly significant. The growth response obtained appeared to occur shortly after thymus feeding commenced, and gradually declined over a period of several weeks.

Another series of experiments was designed to determine whether the growth factor in calf thymus was different from the unidentified chick-growth factors in dried distillers' solubles, dried whey, grass juice, dried brewers' yeast, dried liver, and fish solubles.

The results of these experiments indicated that the thymus growth factor was different from all of those studied. The increased gain which resulted when thymus was added to the various sources of unidentified factors was highly significant.

These results prompted hormonal studies with calf thymus which included its effect on organ weights of normal, thymectomized, castrated, and thiouracil-treated chicks. In addition, a combination of these treatments was included.

The nature of the chick response to calf thymus, and the effects on the organs studied, suggested that the growth factor was a hormone or group of hormones.

Thymectomy per se had no significant effect on growth, gonad weight, or bursa weight in either sex. Post-mortem observations of chicks thymectomized for 20 to 73 days revealed no thymus regeneration.

139 pages. \$1.74. MicA 55-1229

AGRICULTURE, PLANT CULTURE

THE INHERITANCE OF MATURITY AS MEASURED BY TIME OF SILKING; AND OTHER CHARACTER ASSOCIATIONS IN ZEAMAYS

(Publication No. 11,961)

William Kwesi Agble, Ph.D.
University of Minnesota, 1954

The inheritance of maturity coupled with the effectiveness of selection for earliness as determined by progeny tests of selfed lines from F_2 and reciprocal backcrosses form the objective of the present investigation. The morphological and physiological manifestations of maturity, as date silk and per cent moisture at harvest, are utilized as criteria for maturity. The continuous expression of the characters demands use of genetic analytic methods developed for quantitative character studies.

The present investigation included two groups, each consisting of an early (P_1) and a late (P_2) parent, the F_1 , F_2 , B_1 and B_2 generations. Fourteen replications for group A and thirteen replications for group B were planted. A complete randomized block design was used in which the parents and generations were randomized within replications. Data were recorded on individual plant basis. On the basis of silking dates, ten early and ten medium plants were selected in the F_2 , B_1 and B_2 . The medium plants were five days later in silking dates than the early plants. Two hundred and ten seeds from each selected ear were grown in six replications. The frequencies of plants that silked each day were recorded.

The methods developed by Powers et al. were used to calculate the genetic and environmental variances and in determining the number of major-genes governing the expression of the characters. The basis of Powers' theorem for deriving the genetic variances assumes a linear relationship between means and variances of the non-segregating populations. The mathematical application of this concept is treated in the thesis.

In the comparison of F_1 with P_1 in group A, date

silk indicated the presence of either heterosis or complementary factors. Complete dominance was observed in the following year. Four factors with duplicate and recessive suppressor interactions were hypothesized for the inheritance of date silk in this cross.

In group B, four factors were postulated for the character date of silking.

Partial dominance for earliness was noted for per cent moisture at harvest in both crosses. Three factors were postulated for per cent moisture in both groups.

It is revealed that a few genes, 3-5, are probably effective in the inheritance of maturity. This from practical observation appears small. But the pronounced environmental reaction of the P_1 points to the fluctuation that can be expected due to agents other than genotype.

The scales of measurement gave evidence of some limitations. However, the high calculated correlation values revealed that the two characters for maturity were associated. Four factors were shown probable for date silk and three factors for per cent moisture which meant that after flowering, the physiological determinants of maturity approximated an equilibrium that was less fluctuating than for date of silking. It was deduced that the genes governing date silk are probably not the same genes conditioning per cent moisture at harvest. Complete dominance was noted for date silk and partial dominance for per cent moisture. The limitations of the two characters also suggest that use of both characters in breeding for earliness should yield more effective results.

Transgressive segregation for earliness was observed.

Selection for date silk seems very effective as is indicated by the high Chi-square values of independence. The heritability value of the characters favors the concept that probably fewer genes, 3-5, control maturity in corn.

An application of the investigation to conventional corn breeding methods suggests that backcrossing to late parents in the development of earlier corn inbreds might be a feasible breeding procedure.

91 pages. \$1.14. MicA 55-1230

THE EFFECT OF PRESERVATIVES ON DRY MATTER LOSSES THAT OCCUR WHEN IMMATURE UNWILTED FORAGE IS ENSILED

(Publication No. 11,892)

Keith Reid Allred, Ph.D.
Cornell University, 1955

Twenty-four small silos and four large silos were used over a three and two year period respectively in studying the effects of different treatments on the storage losses that occurred when early cut unwilted forage, containing a high proportion of red clover, was ensiled with and without added preservative materials. Feeding value of the resulting silages from the large silo study was also investigated. Some of

the materials studied as preservatives were: sodium metabisulfite, molasses, and dried brewers' grain in the large silo experiment and also in small silos; sulfur dioxide in the small silos; Kylage and wilting, to a limited extent, in small silos and in other large silos.

During the course of this study each small silo was filled seven times and each large silo twice. Silage made without a preservative was used as a check and all treated silage was compared with it on the basis of dry matter losses, color, odor, pH and from the large silo experiment, on feeding value.

Satisfactory silage was obtained when unwilted forage was ensiled without the use of a preservative. It was darker in color than the original forage and was free of any strong odor. Total dry matter losses in the small silo experiments for the untreated silage ranged from 8.3 to 23.8 per cent. Losses through juice runoff varied from nil to 12.2 per cent and by fermentation from 6.7 to 21.3 per cent of the dry matter ensiled. Surface spoilage was eliminated for all practical purposes in this phase of the study.

Large silo results on the untreated silage for 1952 and 1953 were, respectively: pH 4.62 and 4.58, dry matter lost in juice runoff 6.82 and 7.96 per cent, surface spoilage 6.23 and 6.67 per cent, fermentation 14.34 and 16.24 per cent and total losses were 27.39 and 30.87 per cent of the ensiled dry matter. Nutrient content and feeding value of the silage was good. For the respective years the experimental cows consumed over 100 pounds of untreated silage containing an average of 26.9 and 23.9 pounds of dry matter per cow per day throughout the feeding trials. From this they produced 2.06 and 2.21 pounds of four per cent fat-corrected milk per pound of silage dry matter consumed. Digestibility of the silage dry matter was 62.5 per cent in 1952 and 64.9 per cent in 1953.

Silage treated with sodium metabisulfite retained much of the original green color of the forage, was high in carotene and had an agreeable mild odor. Storage losses were only slightly less than for untreated silage and not enough to offset the cost of the material. Bisulfite was easy to handle and apply, however it was irritating to the eyes and nose of anyone working in the silo.

Grain absorbed approximately one pound of moisture for each pound of grain added and thereby was effective in reducing runoff. It exerted little influence in reducing the overall fermentation losses and over 25 per cent of the dry matter from samples of grain stored in the silage was lost through fermentation.

Molasses improved the palatability of the forage and was effective in lowering the silage pH. Nevertheless it was considered unsuitable as a preservative for high moisture forage since approximately 15 per cent of the ensiled molasses was lost in the juice runoff and a considerable amount was lost through fermentation.

Sulfur dioxide was the most effective preservative studied in reducing fermentation losses. Silage preserved with it had a brighter color, less odor and a lower pH than untreated silage. Some of the disadvantages encountered in using sulfur dioxide was its

high cost, the difficulty of handling it and the time involved in treating the ensiled forage.

The large silo study indicated that the feeding value of unwilted silage made with the four different treatments was quite similar since there was no significant difference between them in dry matter consumed, body weight changes, four per cent fat-corrected milk produced or digestibility of silage dry matter.

Considering the influence of the different preservatives on silage produced from immature unwilted forage containing over 50 per cent red clover, it was concluded that in view of the high cost none of them decreased storage losses or improved the feeding value sufficiently over untreated silage to warrant their use.

147 pages. \$1.84. MicA 55-1231

STUDIES ON THE IRRIGATION OF POTATOES, ONIONS AND SNAP BEANS: I. THE EFFECTS OF THE IRRIGATION OF SEVERAL VEGETABLE CROPS AT DIFFERENT LEVELS OF AVAILABLE SOIL MOISTURE. II. A STUDY OF THE RELATIONSHIP BETWEEN SOIL MOISTURE AND NITROGEN LEVELS, PLANT DEVELOPMENT AND TUBER SET OF THE POTATO (*Solanum tuberosum*).

(Publication No. 11,897)

George Alexander Bradley, Ph.D.
Cornell University, 1955

The object of part I of this study was to determine the effects of irrigating a number of vegetable crops when the available soil moisture had dropped to different levels.

Potatoes, onions and snap beans were grown under field conditions over three seasons and irrigated at different levels of available soil moisture ranging from 50 per cent downward. Snap beans were also grown in the greenhouse during three different seasonal periods and were watered when the available soil moisture dropped to different levels ranging from 75 per cent downward.

There was a direct relationship between the yield of potatoes and the available moisture at the time of irrigation during all three seasons. Increased yields as a result of maintaining the available moisture above 50 per cent resulted either from an increase in the number of marketable tubers, an increase in the average size of the marketable tubers or a combination of the two.

There was a direct relationship between the yield of onions and available moisture at the time of irrigation. This was due almost entirely to increased bulb size since uniform stands were obtained in all plots.

There was also a linear relationship between the growth of snap beans and available moisture under both field and greenhouse conditions. The detrimental effect of letting the soil moisture drop lower appeared to be enhanced by hotter, more drying conditions.

Part II of this study was carried out to determine the effect of different combinations of moisture and nitrogen levels upon early plant development and tuber set of the potato under field conditions.

Two plantings of potatoes were made during 1954. Five levels of available moisture and three levels of nitrogen were provided. Plot covers were provided to keep off the rainfall in some of the treatments. Harvests were made at four weekly intervals beginning just when the first tubers were being set.

The major effect of moisture level upon tuber set was upon the earliness of set. Maintaining high moisture levels resulted in earlier set, greater tuber weight and greater top weight.

There was a tendency for the higher nitrogen levels to produce greater top weight. There was no significant effects of nitrogen upon the number of tubers except that the high level tended to increase later in the season while the low level decreased. There may have been an effect of carbohydrate-nitrogen ratio on tuber weight but most of the effect upon tuber weight was closely and directly related to the effect upon top weight.

These experiments indicate the desirability of irrigating light textured soils before the available moisture drops much below 50 per cent. The opinion is expressed that plaster of Paris moisture blocks and a moisture meter would be a worthwhile investment for growers with irrigation systems.

165 pages. \$2.06. MicA 55-1232

**THE NATURE OF THE TOXICOGENIC
CONDITION RESULTING FROM THE
FEEDING OF THE TOMATO PSYLLID
PARATRIOZA COCKERELLI (SULC)**

(Publication No. 11,970)

Leslie Bernard Daniels, Ph.D.
University of Minnesota, 1954

Adviser: Alexander A. Granovsky

The study includes a review of the psyllid yellows disease affecting potatoes and tomatoes in Colorado and other Rocky Mountain states. The importance of solanaceous hosts such as matrimony vine Lycium halimifolium and buffalo bur Solanum rostratum in respect to distribution and build up of psyllid populations is presented.

The effect of the toxemia on potato yields is so manifest that a graphic representation of the annual average yield per acre in a typical potato producing area shows which years had psyllid epidemics. Since 1929, there have been twelve such seasons in which potato yields were noticeably reduced by psyllid yellows. The use of insecticides has modified the influence of psyllid outbreaks upon potato production.

The symptoms of toxemia in potatoes and tomatoes show that the toxin enters into a chemical action within the meristematic areas of the plant, affecting the growth processes. The breaking of dormancy in potatoes and the increased flower and fruit production

in tomatoes indicate that a disturbance in the growth regulators occurs. Hyperplasia, rosetting, and retarded growth in potatoes, elongation of the internodes and axillary growths in tomatoes are further evidence of an influence upon the mechanisms of plant growth.

It has been demonstrated in greenhouse experiments with tomato plants that nymphs and adults have the ability to cause psyllid yellows. Adults are equally as potent as nymphs. The intensity of the toxicogenic reaction varies with the number of insects feeding. Using plants heavily laden with psyllid toxin, transmissibility has been demonstrated, but subsequent transfers of tissue showed a gradual dissipation of the toxic principle. Additional evidence of recovery was obtained from vegetative propagation. Cuttings made of diseased tomato plants exhibited a gradual recovery in the third and fourth transplantings. The toxemia is nonpersistent and has been identified as a reversible reaction of an order similar to DDT and 2,4,D.

Attempts to transmit leaf-roll and aster yellows with psyllids have been unsuccessful.

The symptoms of the two virus diseases are similar to those of psyllid yellows. The establishment of the presence or absence of psyllid nymphs on the plant is an important criterion for psyllid yellows. Leaf rolling develops as a toxicogenic reaction from aphids as well as from psyllids. The positive diagnosis of current season infections of leaf-roll with populations of aphids or psyllids present is difficult. Aster yellows in potatoes has been distinguished from psyllid yellows largely on a basis of net necrosis in the tubers.

127 pages. \$1.59. MicA 55-1233

**A STUDY OF SOME OF THE FACTORS
AFFECTING THE YIELD AND FRUIT
QUALITY OF CONCORD GRAPES
(Vitis labrusca)**

(Publication No. 12,024)

Chester Gene Forshey, Ph.D.
The Ohio State University, 1954

Adviser: Freeman S. Howlett

In recent years grape yields have declined alarmingly in Ohio. In the face of high production costs and reduced prices, high yields have become essential to the profitable operation of the vineyard. The inability to obtain satisfactory yields has resulted in the abandonment of many vineyards, and all evidence indicates that, unless yields improve, many more vineyards will suffer a similar fate. This study was carried out in an effort to determine to what extent inadequate fertilization and improper soil management practices have been responsible for the decline in yield of Ohio vineyards. The effect of certain of these practices on fruit quality was also investigated.

Procedure

A nutrient element survey of Ohio Concord vineyards was conducted in 1952. In July, 83 foliage

samples were collected from 56 vineyards. The petiole portions were analyzed for total nitrogen, phosphorus, potassium, calcium, magnesium, manganese, iron, boron, copper, and zinc. Sixteen representative vineyards were selected from the above 56 for further study.

At harvest, yield was measured in each of the 16 representative vineyards. Soil samples were collected for air space porosity, total porosity, volume weight, pH, and organic matter determinations. Fruit samples were collected for soluble solids, pH, and titratable acidity determinations. The soluble solids/acids ratio was used as an index of quality.

In 1953 foliage samples were collected from the 16 representative vineyards in mid-June, mid-July, and mid-August. Petioles and leaf blades were analyzed separately for the elements listed above. Soil samples were taken in June, August, and at harvest, and the same determinations were made as in 1952. Yield was measured at harvest, and fruit samples were again collected for quality analysis.

Results

Both petiole and leaf blade content of nitrogen and potassium decreased sharply during the growing season. The concentrations of calcium and magnesium increased in both tissues. Phosphorus content decreased in the leaf blades but remained constant in the petioles. Manganese increased in the petioles but decreased in the leaf blades. The reverse was true of iron.

The nitrogen and mineral content of the foliage was more closely associated with yield in July than in June or August.

Leaf blades were better indicators of the nutritional status of the vines with respect to nitrogen, boron, copper, and zinc than the petioles. The reverse was true for phosphorus, potassium, calcium, magnesium, manganese, and iron.

High yields were associated with relatively high levels of nitrogen, phosphorus, and potassium and with low levels of magnesium.

Definite deficiencies of only four elements were identified. These were nitrogen, phosphorus, potassium, and manganese.

On the basis of the results of this study the following optimum levels are proposed for mid-shoot leaves sampled in mid-July: nitrogen - 3.00 per cent in leaf blades; phosphorus - 0.20 per cent in petioles; potassium - 1.50 per cent in petioles; and manganese - 30 ppm. in petioles.

Air space porosity was more closely related to yield than total porosity or volume weight. Correlation between this soil characteristic and yield was highly significant.

Neither soil pH nor total organic matter appeared to be directly related to yield.

The results indicated that the soluble solids/acids ratio was not a completely satisfactory index of quality. Better quality standards are definitely needed.

The soluble solids/acids ratio was inversely related to yield. It is suggested that an effort be made

to compromise between highest yield and highest quality.

Ohio Concord vineyards should receive fertilizer as indicated by the results of chemical analysis of appropriate foliage sampled in mid-July.

An effort should be made to incorporate into the vineyard soil management program, practices which will result in the improvement of soil structure.

215 pages. \$2.69. MicA 55-1234

SOME FACTORS INFLUENCING CALCIUM-BORON RATIOS IN PLANTS

(Publication No. 12,029)

Bryce Carroll Gray, Ph.D.
The Ohio State University, 1954

Adviser: Parker F. Pratt

Several states neighboring Ohio have reported boron deficient soils and are recommending applications of boron for these soils in order to obtain maximum crop yields. Although boron deficient soils have not been reported in Ohio, it is conceivable that such deficiencies will occur in the near future and will necessitate B fertilization. Since the range between deficient and toxic levels of boron in soils is narrow, it is desirable to set up a criterion to determine when additions of B will be beneficial or detrimental to plant growth. One such criterion that has been proposed is the Ca-B ratios in tissue of various crop plants. However, judicious use of these ratios requires an appreciation of the factors influencing them. Any factor influencing either the Ca or B content of plants will be reflected in the ratio. The purpose of this study was to evaluate some of these factors: root cation exchange capacity; available Al^{+++} , Mn^{++} , and H^+ ; and source of boron.

Root Cation Exchange Capacity. Six grain crops and nine pasture crops of varying root cation exchange capacity were grown under greenhouse conditions in sand cultures at levels of B considered to be deficient, optimum, and toxic. Results for the grain crops showed that the Ca content increased, and the B content decreased, in the plant tissue with increasing values of root exchange capacity. Plotting Ca-B ratios against root exchange capacity resulted in a significant relationship between these quantities except at the toxic level of B. At this level, the differences between species were overcome because of "luxury consumption" of B. For the pasture crops the relationships were not well defined. It is believed that B contamination in the cultures was sufficient to mask species differences.

Available Al^{+++} , Mn^{++} , and H^+ . Soybeans were grown in gravel and solution cultures at 10 and 100 p.p.m. each of Al^{+++} and Mn^{++} . The hydrogen treatment was prepared by adding HCl to the nutrient solution until its acidity was pH 4.0. The highest level of Al not only inhibited Ca absorption, but

indications were that Ca was released from the plants by this treatment. Although significant differences were not obtained, the boron content of the plant tissue was consistently lower at the Al treatments than at the Mn or H treatments. Calcium-boron ratios were not influenced by treatment. However, high Al concentrations in soils may result in these ions being present in the plant in too low a level for optimum growth, even though they are in the proper proportion. A species difference between soybeans and alfalfa in the release of Ca by Al was found, using a series of solutions of varying Al concentration.

Source of Boron. The effects of two readily soluble inorganic B compounds and two boron-containing fritted materials were compared using soybeans followed by four cuttings of alfalfa in sand cultures. Treatments were 0.0, 0.01, 0.1, 0.5, 1.0, 2.5, and 5.0 p.p.m. of boron. In contrast with sodium borate and boric acid, the fritted materials did not cause B toxicities or reduce yields on boron sensitive soybeans at high rates of application. With boron tolerant alfalfa, the source of B did not influence yields at the rates used. The fritted materials did not significantly increase the B content of the plant tissue until the second cutting of alfalfa, indicating that these materials are better suited as a form of insurance against B deficiencies than as a means of quickly raising the B level of deficient soils. Sodium borate and boric acid treatments resulted in a wide range of Ca-B ratios in plant tissue; whereas, with fritted materials, the ratios were more nearly uniform.

Boron contamination was a serious factor in these experiments, and further work on factors influencing Ca-B ratios is recommended under more controlled conditions. 82 pages. \$1.03. MicA 55-1235

SOIL MOISTURE DEPLETION BY VARIOUS GRASSES AND LEGUMES USED AS ORCHARD SODS

(Publication No. 12,142)

Roscoe John Higdon, Ph.D.
Michigan State University, 1953

Sod covers of white dutch clover, ladino clover, timothy, redtop, quackgrass, bluegrass, and fescue were grown for two years on plots of Miami silt loam soil. The effect of mowing the sods on soil moisture depletion was the primary purpose of the study. Gypsum soil moisture blocks were placed at 8, 16, 24, 32 and 40 inch depths for the purpose of soil moisture determinations.

The various sod covers showed considerable differences in soil moisture depletion as well as differences in response to mowing. The intensity and distribution of rainfall in relation to the time of mowing appeared to have marked effects on soil moisture depletion by the sod covers. Mowing of non-legume sod covers during periods of deficient soil moisture appeared to conserve soil moisture; however, when

soil moisture is not lacking mowing tended to result in increased soil moisture depletion. When mowing resulted in conservation of soil moisture the effect was only temporary and late in the season the mowed sods were depleting soil moisture more than unmowed sods. Mowing sod covers in orchards cannot be depended upon for the conservation of sufficient quantities of soil moisture for best tree growth and production of orchard trees under Michigan conditions.

Bluegrass, fescue, timothy, and redtop sod covers showed less depletion of soil moisture than sod covers of ladino clover, white dutch clover, alfalfa, and quackgrass. 121 pages. \$1.51. MicA 55-1236

CRITICAL PERIODS IN THE APPLICATION OF 2,4-D TO CORN

(Publication No. 12,172)

Richard Demetry Ilnicki, Ph.D.
The Ohio State University, 1955

Introduction

The use of 2,4-D for the control of weeds in corn has become an accepted practice. Although corn is moderately resistant to injury from this herbicide, some losses in yield have occurred even when 2,4-D was used at recommended rates. Conflicting statements as to the stage of growth at which corn is most readily injured appear in the literature.

This investigation had three purposes: (1) to establish, if possible, the periods or stages of growth when corn was most susceptible to 2,4-D; (2) to study the environmental conditions that prevailed prior to the date of treatment when corn was most readily injured; and (3) to determine as far as possible the relationships between stages of growth, environmental conditions, and severity of injury to corn by 2,4-D.

Materials and Methods

In 1952 one set of triplicated plots was sprayed every 24 hours for 35 days with one rate of two 2,4-D formulations, an alkanolamine salt and an isopropyl ester. In another set, a wide range of rates of the same formulations was applied every three days. In 1953, eight rates of both formulations were applied every two days.

The stage of development at treatment was described by the height and the number of leaves which had emerged. Responses were described qualitatively and quantitatively so far as possible.

Results

Yield of grain was reduced by high rates of 2,4-D at several stages of growth, different in the two years. The ester was always more injurious than the amine salt, but no stage was consistently hazardous.

Stalk bending, leaf roll, reductions in leaf width, and temporary stunting in growth were produced by treatments applied at stages when conditions were favorable for rapid growth, particularly at

high temperatures accompanied by high soil moisture.

Brittleness following treatment was greatest in the 3-leaf to 9-leaf stages. Tall plants were more susceptible to stalk breakage than short plants because of their greater weight. Brittleness was more severe when soil moisture was high.

Fasciation of brace roots was characteristic of plants treated at the 6-leaf to the 9-leaf stages. Temperature and soil moisture had no apparent effect on this response.

Onion leaf, a condition in which the upper leaves fuse together into a tight cylinder-like structure, was characteristic of corn treated in early stages of development when rain immediately followed 2,4-D treatment.

Tassel emergence was delayed on plants manifesting severe onion leaf and in those plots retarded in growth by dense stands of weeds. However, these tassels eventually emerged and appeared normal.

Rates of one pound and more of both formulations of 2,4-D produced the above responses. The intensity of these responses was always greater with the ester than with the amine treatments. No barren or abnormal tassels were seen at any time.

Conclusions

From these experiments it is concluded that there is no stage of growth up to six weeks after planting which in itself is particularly dangerous for 2,4-D applications. Under proper environmental conditions, particularly periods of high soil moisture, high temperature, and rapid growth, corn may be seriously injured at any stage.

100 pages. \$1.25. MicA 55-1237

THE DIFFERENTIAL RESPONSE OF WHEAT VARIETIES TO DIFFERENT LEVELS OF NITROGEN

(Publication No. 11,905)

William Howard Isom, Ph.D.
Cornell University, 1955

Winter wheat was grown near Ithaca, New York in 1952-53 and 1953-54 to determine the effects of different levels of nitrogen on varietal performance. The varieties (Honor, Forward, Valprize, Yorkwin, Nured, Cornell 595, Genesee, C.I. 13078, C.I. 13079, and Alaskan) were developed at the Agricultural Experiment Station of Cornell University, except Alaskan. Treatments applied were 0, 20, 30, 40, and 50 units of available nitrogen per acre. The tests performed at 2 locations each year were arranged in a split-plot design with treatments as whole plots and varieties as subplots. Varietal responses measured were intervarietal competition, yield of grain, test weight of grain, and height of straw. Competition and height were measured on a single test each year. Yield and test weight were measured on all 4 tests.

Varieties were different in their competitive

abilities as measured by yield comparisons of center and outside rows of 3-row plots. Competitive ability did not appear to be associated with high yielding ability. The varieties Nured and C.I. 13079 were the strongest in competitive ability. Competitive ability was not affected by different nitrogen treatments, and the treatment x variety interactions were not significant.

In yield of grain, varieties differed by odds of 99 to 1 in all 4 tests. The new varieties were the highest yielding. Varietal yields and yield ranks varied from test to test, but the highest yielding varieties were relatively consistent in their yield rank.

The effects of the different treatments on yield of grain were not different in 2 tests, but were significantly different in the other 2 tests. No treatment could be singled out as the best at which varietal trials should be made.

Varieties interacted significantly with treatments in the yield tests in 1953-54, but not in 1952-53. The range of greatest variation in varietal responses to treatments was between the 30 and 50-pound rates of nitrogen. Any given variety was so inconsistent in its yield response to the different treatments as to make treatment recommendations on a varietal basis inadvisable.

The analyses of variances of test weights indicated odds of 99 to 1 that varieties were different, treatments were different, and the treatment x variety interactions were significant in all 4 tests. Despite this, the only generalizations which could be made were that there was greater variability between varieties than within varieties given different nitrogen treatments. Also, with the exception of C.I. 13078, a white wheat, the red wheats were generally higher in test weight than the white wheats.

Increased rates of nitrogen generally increased the heights of straw of all varieties. Highly significant differences for between treatments and for between varieties were observed. The treatment x variety interactions were not significant. The shortness of the variety Alaskan contributed most to the differences between varietal heights.

The results of this study indicate that nitrogen fertilization may differentially affect the yields and test weights of wheat varieties, but not their height or competitive ability. Because of the inconsistencies of the yield and test weight results, breeding for response to nitrogen would not be advisable without further research on varietal responses to treatments.

105 pages. \$1.31. MicA 55-1238

THE RELATIONSHIP BETWEEN SOIL ANALYSIS AND CULTURAL PRACTICES OF A PEACH ORCHARD

(Publication No. 8503)

Shue Shan Kwong, Ph.D.
Michigan State University, 1954

Information on the soil-mulch interrelationship will aid in the successful use of the sod-mulch system

of soil management in Michigan peach orchards. The purpose of this experiment was to determine the nutritional status of the soil as influenced by mulching and fertilizer applications in the peach orchard.

Experimental Procedure

A peach orchard near Grand Rapids, Michigan contained mulched and unmulched blocks in which there were rows receiving nitrogen (N), nitrogen and phosphorus (NP), and nitrogen, phosphorus, and potassium (NPK). Trees which did not receive any fertilizer were used as a check. A Halehaven tree in each row was selected for soil sampling. Soil samples were taken in August 1952, at five soil depths: 0-4, 4-12, 12-20, 20-28, and 28-36 inches beneath each tree at three locations midway from the trunk to the outer branches. The soil samples were air-dried, crushed with a wooden pin, screened through a 2 mm. sieve, thoroughly mixed and stored in containers for analysis.

Soil pH was determined on a 1:1 soil water suspension with a Beckman model H-2 pH meter. Exchangeable calcium, magnesium, and potassium were determined by leaching a 20-gram soil sample with 200 milliliters of neutral normal ammonium acetate and measured with a Beckman model DU and model B spectrophotometers. The after leached original soil sample was then saturated with 40 milliliters of 10 per cent acidified sodium chloride solution and again leached with 100 milliliters of neutral normal ammonium acetate. The leachate was collected for determining exchangeable sodium photometrically as a measure of the cation exchange capacity. Acetate soluble phosphorus was determined colorimetrically using the standard A. O. A. C. micro-method.

Results and Conclusions

The exchangeable calcium under mulch with fertilizer was lower than unmulched at all corresponding depths. The per cent calcium saturation under mulch and receiving fertilizer was steadily increased as the soil depths increased. Exchangeable magnesium was definitely lower under mulch with nitrogen fertilizer alone. When no fertilizer was applied, the mulched samples showed higher exchangeable magnesium than samples with no mulch. The per cent magnesium saturation under mulch with fertilizer was also lower than samples without mulch.

The exchangeable potassium was higher under mulch at 0-12 inch depths than in other soil depths when nitrogen, nitrogen and phosphorus, or nitrogen, phosphorus, and potassium fertilizer was applied, respectively. However, the amount at 0-12 inches under mulch without fertilizer was lower than the unmulched samples.

A higher cation exchange capacity was found at all soil depths under mulch than the unmulched samples when no fertilizer was applied. A higher exchange capacity and per cent base saturation was also found at the upper depths under mulch with fertilizer.

An increase of acetate soluble phosphorus occurred at the 0-4 inch depth under mulch with fertilizer.

However, a great total amount of acetate soluble phosphorus was found from unmulched than from the mulched samples when no fertilizer was added.

The pH value at the surface soil was decreased under mulch when fertilizer was applied. There was a significant correlation of pH with per cent magnesium saturation, and a highly significant correlation of pH with per cent calcium saturation and with the total per cent saturation with calcium, magnesium, and potassium. A negative correlation of pH to acetate soluble phosphorus was also found highly significant.

The results of this investigation indicated that mulching influenced the nutritional status in the soil. In order to obtain the full advantage of complete fertilizers in such peach orchards, an adequate mulching program should be maintained and the use of dolomitic lime seems desirable.

96 pages. \$1.20. MicA 55-1239

THE EFFECT OF SYNTHETIC POLYELECTROLYTES ON CERTAIN BIOCHEMICAL AND BIOPHYSICAL PROPERTIES OF SOME OHIO SOILS

(Publication No. 12,180)

James Leo Mortensen, Jr., Ph.D.
The Ohio State University, 1955

The possibility of stabilizing favorable biophysical properties of soil by the use of soil-conditioning synthetic polyelectrolytes has been investigated in recent years. The objectives of this study were: (1) to determine the effect of HPAN and VAMA, including fertilizer interactions, on several biophysical properties of soil, and growth, composition, and yield of plants, one and two years after application, and (2) to determine the extent of microbial decomposition, plant absorption, and leaching of these materials from the soil. Field Plot Studies. HPAN (hydrolyzed polyacrylonitrile) and VAMA (a mixture of $\text{Ca}(\text{OH})_2$ and a co-polymer of vinyl acetate and the partial methyl ester of maleic acid) were applied as a powder to plowed Hoytville silt clay in May, 1952, at the rate of 0.12 per cent and incorporated by disking. The experimental design was a split-plot, randomized block factorial with four replicates, nitrogen (150 lbs. N/acre)-phosphorus (75 lbs. P_2O_5 /acre)-potassium (75 lbs. K_2O /acre) fertilization being confounded. Ohio W65 corn was the assay plant. These plots were seeded to Clinton 59 oats in April, 1953, 400 lbs. of 4-16-16/acre being applied to all plots.

Plots on Brookston silty clay loam which had been treated with 0.08 per cent HPAN and VAMA (split plot randomized block with six replications) in May, 1951, were planted in June, 1952, to Ohio W64 corn with a Poyner planted.

HPAN and VAMA were effective in significantly increasing water-stability of aggregates and aeration porosity but had no effect on field moisture percentage, water-holding capacity, moisture equivalent, cation-exchange capacity, or pH . Nitrogen fertilization

and conditioner treatment significantly increased the rate of growth and maturation of corn. Nitrogen fertilization significantly increased the nitrogen content of leaves and grain. Nitrogen fertilization, conditioner treatment, and the nitrogen x conditioner interaction significantly increased the yield of corn. Phosphorus and potassium fertilization had no significant effect on growth, composition, or yield of corn.

Improved soil structure and stability of aggregates was significantly maintained throughout a second season, but the structural indices had declined approximately 10 per cent. Other than the increase in yield of oats as the result of the 1952 nitrogen fertilization, there were no significant differences in the yield of oats and corn in second-year plots.

Studies Involving the Use of Carbon-14 Labeled HPAN and VAMA.

In an incubation experiment of 130 days, radioactive carbon dioxide equivalent to 2.74 per cent of a 0.1 per cent treatment of HPAN and 0.20 per cent of a 0.1 per cent VAMA treatment was produced as a result of microbial activity. Microbial activity, as evidenced by evolution of carbon dioxide, was increased by increasing concentrations of polyelectrolyte. A correlation between total carbon loss and decomposition of polyelectrolyte is suggested.

By growing corn and soybeans in HPAN-treated soil, it was found that small amounts of HPAN are adsorbed on root surfaces, but little, if any, is absorbed and translocated within the plant.

In leaching and lateral movement studies, it was found that HPAN moves with the moving front of aqueous solutions when applied to filter paper and soil. After air-drying, further applications of water and 1N NH_4OH do not desorb and leach the soil-adsorbed HPAN.

180 pages. \$2.28. MicA 55-1240

THE CHEMISTRY OF SUBMERGED SOILS IN RELATION TO THE GROWTH AND YIELD OF RICE

(Publication No. 11,916)

Felix Nelson Ponnampetuma, Ph.D.
Cornell University, 1955

Although rice is almost universally grown on submerged land no physiological reasons have been given for the benefits of this practice. The high iron requirement of rice suggested that increased availability of iron might be one of the benefits of submergence. The occurrence of certain physiological diseases of rice under conditions conducive to the accumulation of reduced substances indicated that excess iron and manganese might be toxic to rice. It was surmised, therefore, that if rice were grown over a sufficiently wide range of reducing conditions it might be possible to delimit the range over which it would not be affected by a deficiency of iron on the one hand and an excess of reduced substances on the other. It was believed that this range could be

characterized by its redox potential and by the concentrations of iron, manganese, nitrate, nitrite, and oxidizable matter in the soil solution and also the concentration of iron and manganese in Morgan extracts of the soils.

The range of reducing conditions was attempted by varying the pH, organic matter content and drainage level of the soil. The influence of these three factors on rice was studied in a 3x3x3 factorial experiment in a greenhouse. The three pH levels were 4.9, 5.7 and 6.0; the organic matter levels were 0.0, 0.2 and 0.4 percent added oat straw; the drainage levels were well drained, submerged with vertical drainage at the rate of 0.4" per day, and submerged with no drainage.

The well drained soils were characterized by a high redox potential and an extremely low concentration of iron and manganese in the soil solutions and much poorer growth and yield than the submerged soils. Among the well drained soils yield decreased with increase in pH and this was paralleled by a decrease in iron extractable in Morgan's reagent.

The submerged soils with drainage, regardless of initial pH and oat straw levels tended to be very similar in their chemical composition. Drainage did not give a range of intermediate redox potentials but it did provide a range of intermediate concentration of reduced products. The remarkable feature of these treatments was the uniformity of yields, like the chemical analyses, over the different pH and oat straw levels.

The submerged no-drainage treatments showed the pH and oat straw effects in a very pronounced form. The pH 4.9 treatments were characterized by incredibly high concentrations of iron and high concentrations of manganese in the soil solution. These treatments exhibited to a marked degree the symptoms associated with "mentek" disease of rice in Java. The high oat straw treatments at the two higher pH levels also showed high concentrations of iron and manganese but the injurious effects were shortlived for the plants made rapid recovery about heading time. Yields were of the same order as those of the submerged with-drainage treatments.

The best yields were associated with the no-oat-straw submerged treatments at pH 5.7 and 6.0. These soils were characterized by a high redox potential, high nitrate and low iron and manganese concentrations during the first four weeks of submergence. Apparently these soils represented a zone of reduction in which rice did not suffer from deficiency of iron nor from an excess of reduced products.

In a subsequent experiment the decrease in yield of rice grown under well drained conditions with increase in pH and its association with reduced availability of iron were confirmed. The unfavorable influence of high pH was largely eliminated by the addition of ferric sodium ethylenediamine tetracetate to these soils. The symptoms associated with high concentrations of reduced substances were observed again in the pH 4.9, submerged no-drainage treatment. The build up of high concentrations of iron and manganese was considerably retarded by the addition of sodium nitrate and prevented by delaying submergence for thirty days.

The results of this investigation suggest: (1) a combination of low pH, high organic matter content and complete absence of drainage may cause a physiological disturbance similar to "mentek" disease of rice; (2) this disturbance may be corrected by subsoil drainage, delaying submergence and by the application of sodium nitrate; (3) a combination of pH near neutrality, presence of nitrate, and absence of fresh organic and of drainage is conducive to high yields; and (4) a low pH is favorable to the growth of rice under upland conditions.

427 pages. \$5.34. MicA 55-1241

GROWTH AND COMPOSITION OF THE STRAWBERRY PLANT IN RELATION TO ROOT TEMPERATURE

(Publication No. 12,146)

Alfred Nathan Roberts, Ph.D.
Michigan State University, 1953

The possibility of correlating growth response of the strawberry plant to certain ecological conditions, namely, root temperature and concentration of the nutrient solution, with organic and nutrient-element composition was studied. The relationship between certain of these organic and ash components and their influence on the total production of dry matter in the root and aerial portions of the plant during its vegetative growth was considered.

Root temperature control was obtained by growing the plants in crocks of sand plunged in temperature control tanks designed especially for this purpose. Concentration of the nutrient solution was maintained by frequent renewal of sand cultures with various concentrations of Hoagland's standard nutrient solution. Growth measurements were based on the total production of dry matter and the number of runner plants produced. Organic and nutrient-element composition of the plant material produced was obtained by standard analytical procedures.

During the vegetative period of development, the growth of aerial portions of the strawberry plant was closely correlated with root temperature. Such a relationship was not present for root growth. Therefore, the top-root ratio increased with higher root temperature.

Maximum dry weight accumulation in both root and aerial portions of the strawberry plant occurred in nutrient solutions of relatively low salt concentration (0.5 Hoagland's solution). However, normal growth occurred in more concentrated solutions. On the basis of dry weight accumulation, maximum growth of all aerial parts of the plant during this vegetative phase of development occurred at root temperatures between 65° and 75° F, regardless of nutrient solution concentration. There was no significant difference in dry weight of roots within the range of root temperatures used in this study (45° to 75° F), regardless of nutrient solution concentration.

Although root temperature had a pronounced effect on the total growth of the aerial portions of the

plant, the organic composition of the foliage was not significantly altered by differences in root temperature. However, there were significant changes in the organic composition of the roots with root temperature. Temperature effects upon organic components appeared to be more or less localized within the plant part subjected to differential temperature treatment.

Root temperature appeared to have very little, if any, appreciable effect on the nutrient-element composition of the aerial portions of the plant. Total ash of the roots was subject to greater influence from root temperature differences than was the foliage.

The total concentration of salts in the nutrient solution had no appreciable effect on the percentage of crude fiber and ether-extractable materials, but influenced the percentage of nitrogenous and metabolizable carbohydrate (N-free extract) components in both the leaf and root tissue. The concentration of salts in the nutrient solution had a marked effect on both the total ash content and several of its components in root and leaf tissues.

A significant negative correlation was found to exist between the metabolizable carbohydrate (N-free extract) and nitrogenous (protein) fractions in the roots and foliage of the strawberry. A significant negative correlation was found also to exist between the content of ash and these metabolizable carbohydrate fractions in the roots and foliage. The same was true for these carbohydrate materials and the ash component, potassium.

The possible influence of root temperature and "luxury" absorption of nutrient elements on the efficient utilization of organic fractions and efficiency in dry weight production was considered.

107 pages. \$1.34. MicA 55-1242

THE PHOSPHORUS SUPPLYING POWER OF SOME NEW YORK SOILS AS DETERMINED BY POT AND CHEMICAL METHODS

(Publication No. 12,281)

Nicolas Sanchez, Ph.D.
Cornell University, 1955

This study dealt with the relationships between the amounts of phosphorus extracted from various soils by the following four chemical methods:

1) Rapid test, 2) Sodium bicarbonate, 3) Continuous leaching by percolation, and 4) Anion exchanger and the cumulative yields, total removal of phosphorus, and relative yields from five successive crops. Determinations of available phosphorus were made on the original soil and subsoil samples, using the four chemical methods indicated above.

There were twenty one soils including one Brown Forest, eight Gray Brown Podzolic, ten Brown Podzolic, and two Podzols. All soils were upland cultivated soils from farmer's fields. Soils and subsoils received two fertilizer treatments previous to the planting of each crop, one including nitrogen, phosphorus, and potassium and the other nitrogen and potassium.

Soils and subsoils were subjected to continuous cropping and five successive crops were grown and harvested from pots as follows: Romaine lettuce, Connecticut 845 hybrid corn, Essex rape, commercial Sudan grass and Romaine lettuce. The first three crops were grown out-of-doors and the other two in the greenhouse. The tops from each crop were harvested and oven-dried to determine dry matter yields. The dry plant material was analyzed for phosphorus. The total cumulative yields of dry matter were obtained for the five crops. Relative yields were calculated for the soils and subsoils receiving the nitrogen and potassium treatment as compared with the nitrogen, phosphorus, and potassium treatment, which was taken as one hundred percent yield. Total amounts of phosphorus removed by each crop were calculated from dry matter yields and phosphorus composition of plants.

The average of total production of dry matter per two million pounds of soil, the average total phosphorus removal by crops, and the average relative yields for crops grown on the nitrogen and potassium treated soils and subsoils indicated that the phosphorus supplying power for the soil groups was as follows: Brown Forest, Gray Brown Podzolic, Brown Podzolic, Podzol.

Results indicated that the percentage phosphorus composition of crops was not only a function of the phosphorus supplying power of soils, but also of the crop itself and environmental conditions. Corn in general, had lower concentration than any of the other crops.

Results from chemical methods were as follows: The sodium bicarbonate and anion exchanger methods extracted larger amounts of phosphorus from all soil groups than the other two methods. The rapid test, continuous leaching, and anion exchanger methods placed the soil groups in the same order as cumulative yield, total phosphorus removal, or relative yield.

The correlation coefficients between the amounts of phosphorus extracted by any of the chemical methods and cumulative yield, total phosphorus removal by crops, or relative yield were highly significant in the case of surface soils. The continuous leaching method showed the highest correlation coefficients with all factors mentioned.

For the subsoils the relationships indicated that there was significant correlation between the anion exchanger method and the phosphorus removal by crops, between the sodium bicarbonate method and cumulative yield, and between the rapid test and relative yield.

The accuracy of prediction for all methods was greatly reduced when the great soil groups were considered separately.

The total phosphorus removal by crops appeared to be the best guide for separating the soil tests according to their accuracy to determine the phosphorus supplying power of soils and subsoils. The continuous leaching and anion exchanger methods predicted with a high degree of accuracy the phosphorus supplying power of the soils investigated. The quicker and easier rapid test and sodium bicarbonate methods

had a slightly lesser accuracy of prediction even though they were highly significant when correlated with crop growth factors.

150 pages. \$1.88. MicA 55-1243

THE INFLUENCE OF ENVIRONMENTAL FACTORS ON THE NODULATION AND YIELD OF BIRDSFOOT TREFOIL

(Publication No. 11,919)

Jay Hamilton Smith, Ph.D.
Cornell University, 1955

Even though a great deal of research has been done on the establishment of perennial legumes, seedling failures continue to occur. This is especially true with legumes that are being grown for the first time. Birdsfoot trefoil is a legume that is gaining prominence in many areas and the problem of its establishment in the first year is still acute. Nodulation of this legume is often initially poor even though inoculants are used which have been tested in the greenhouse and proved effective. This points to factors other than the nature of the inoculant. Physical and environmental factors seem to play an important role in nodulation and yield of birdsfoot trefoil.

The influence of three levels of soil moisture (22.6%, 27.6%, and 32.6%) on yield and nodulation of birdsfoot trefoil were evaluated using Mardin silt loam, pH 5.1, Mardin silt loam, pH 5.8, and Dunkirk silt loam. The highest yields were obtained at 32.6 percent moisture on the Mardin soils and at 27.6 percent moisture on the Dunkirk soil. Nodulation was good at all three moisture levels. It is thus concluded that moisture levels at which birdsfoot trefoil grows well will not limit nodulation. Birdsfoot trefoil responds well to abundant moisture and is especially well suited for growth in the low, wet soils of the northeast.

The influence of soil pH on yield and nodulation of birdsfoot trefoil was determined. The optimum pH for yield was about 6.2. Nodulation was good from pH 5.0 to pH 7.5 with some limitation of nodulation beyond these extremes. Effective strains of *Lotus Rhizobium* are relatively tolerant to a wide pH range. For maximum yields it is necessary to maintain the pH of the soil above 5.5.

In other experiments soil temperature was controlled by means of a water bath which was maintained at constant temperatures of 43° F ± 2° F, 52.4° F ± 2° F, and again 43° F ± 2° F. Birdsfoot trefoil was grown and the extent and effectiveness of nodulation determined. A heavy isotope N¹⁵ was used to determine effectiveness of nodulation. The lower temperature limit for nodulation was found to be between 45° and 50° F. Some cultures proved effective in nitrogen fixation slightly above the limiting temperature and some were ineffective. In New York it is possible for nodulation to be limited by low temperature in all months except June, July, August, and September. This influences early spring plantings of

birdsfoot trefoil and explains at least in part the reason for failures with fall seedings of birdsfoot trefoil.

Longevity of *Rhizobium* in the soil has not been fully evaluated. The soil pH influences longevity greatly with pH values 4.5 and 8.0 seriously limiting longevity. The optimum value is about neutrality although the Lotus group is tolerant to a relatively wide pH range.

Respiration and growth of *Rhizobium* was determined by Warburg and turbidimetric methods for three strains. Optimum pH for respiration varied from 6.3 to 8.3 depending on the strain, and optimum pH for growth varied from 6.4 to 7.6, depending on the substrate concentration.

Results in the field indicate that the nature of the inoculant culture is one of the most important factors in nodulation. Nod-O-Gen and Nitrogin cultures proved effective. The use of a carbohydrate adhesive seems to aid in survival of the *Rhizobium* as reflected in nodulation but this is not yet conclusive. The use of highly effective and competitive inoculant cultures is necessary for obtaining good nodulation.

The use of nitrogen fertilizers at low rates of application is advisable to aid the establishment of seedling legumes. 105 pages. \$1.31. MicA 55-1244

GRANULATED VERSUS NONGRANULATED FERTILIZERS: EFFECT UPON YIELD AND UPTAKE OF PHOSPHORUS BY SEVERAL CROPS

(Publication No. 12,158)

Boyce Cochran Williams, Ph.D.
Michigan State University, 1955

Two greenhouse experiments and three field experiments were conducted to ascertain the effect of

granulation, placement, and rate of application of fertilizers upon the yield, phosphorus content, fertilizer phosphorus uptake, and utilization of fertilizer phosphorus by wheat, beans, and sugar beets.

Fourteen different soils were used in this series of studies. The soils ranged in texture from loamy sands to clay loams, in pH from 5.1 to 7.6, and in available phosphorus from 4.8 to 125 pounds per acre.

The fertilizer materials used were ordinary superphosphate, 0-20-20, 3-12-12, 4-16-16, and 10-10-10 in both granular and nongranular forms. Formulations of 8-16-8, slurry process, ammoniated, and nonammoniated, in nongranular form were used in the 1953 greenhouse experiment.

Uptake of fertilizer phosphorus in all crops was increased by fertilizer application. Increasing the rate of application of phosphorus tended to increase the amount of total phosphorus taken up by the three crops. Banded placement of fertilizers tended to produce plants higher in fertilizer phosphorus than did similar amounts of broadcast material. These effects were not so evident for the total phosphorus content of the three crops.

Banded placement of fertilizers generally resulted in a higher utilization of applied phosphorus than did broadcast placement. Increasing the rate of application of fertilizers tended to decrease the percentage of fertilizer phosphorus utilized though it increased the actual amount taken up by the three crops.

Yields tended to be increased by the banded placement and by the increasing of the rate of application of fertilizers.

Granulation of the fertilizers had no consistent effect upon yield, phosphorus content, fertilizer phosphorus uptake, or utilization of applied phosphorus by the three crops grown. In those cases where granulated fertilizer had more effect on the above factors than did nongranular material, the broadcast placement was involved.

118 pages. \$1.48. MicA 55-1245

ANATOMY

CYTOCHEMISTRY AND MORPHOLOGY OF THE CELLS OF THE HEMOPOIETIC SYSTEM

(Publication No. 12,003)

G. Adolph Ackerman, Ph.D.
The Ohio State University, 1954

Adviser: R. A. Knouff

The present study has been directed toward a better understanding of the cytochemistry and morphology of the cells of the hemopoietic system in both health and disease. Critical morphologic observation has been combined and correlated with extensive cytochemical studies in an attempt to study the growth and development of these cell forms.

Material studied in this investigation has included human lymph nodes, blood and bone marrow from various neoplastic and nonneoplastic conditions, and lymph nodes and spleens from rats treated with anti-leukemic agents. A wide variety of cytochemical procedures has been employed which include techniques for the demonstration of pentosenucleoprotein, desoxypentosenucleoprotein, mucopolysaccharides, glycogen, lipids, phosphatases and sulfhydryl groups.

Cytochemical changes occur prior to discernible morphologic differentiation in the cells of the lymph node. These changes appear to be quantitative rather than qualitative in nature.

Cytochemical differences exist between cells of normal lymph nodes and the modified cells of Hodgkin's disease, reticulum cell sarcoma, lymphosarcoma,

lymphatic leukemia and Boeck's sarcoid. Observation of cytochemical changes aids in the diagnosis of these disease conditions.

Cytochemical evidence indicates that the reticulum cell gives rise to the Hodgkin's cell. During the formation of the Hodgkin's cell there is a gradual increase in acid phosphatase of the nucleus and nucleolus, followed by an increase in pentosenucleoprotein of both the cytoplasm and nucleolus and an elaboration of lipid and mucopolysaccharide granules. Acid and alkaline phosphatase activity continue to increase as the cell matures and undergoes degeneration.

Cellular growth following *in vitro* cultivation of human lymph nodes depends upon the cellular constitution and degree of stimulation of the various cellular elements.

Elongate reticulum cells and reticular clasmato-cytes occur in greater numbers in cultures from nodes exhibiting neoplastic and nonneoplastic reticulum cell hyperplasia (Hodgkin's disease, reticulum cell sarcoma, Boeck's sarcoid, reticulum cell and follicular hyperplasia) than from nodes having a less marked reticulum cell hyperplasia (giant follicular lymphoblastoma, lymphosarcoma, lymphatic leukemia and lymphadenitis).

Following *in vitro* cultivation lymph node cells exhibit an elaboration of neutral fat, lipid, plasmalogen, mucopolysaccharides and an increase in phosphatase activity. Lipid droplets are present in greater number in cells grown from nodes with the histopathologic diagnosis of Hodgkin's disease, reticulum cell sarcoma and lymphadenitis.

Immediately following X-radiation, the cells of the lymph node and spleen exhibit cytochemical changes prior to discernible morphologic alterations. Other antileukemic agents, i.e., nitrogen mustard, triethylene melamine and aminopterin, have a different mode of action upon the metabolism of the hemopoietic cells since morphologic signs of degeneration are apparent before changes in their cytochemistry are detectable with the techniques employed.

The cells of the blood and bone marrow from various blood dyscrasias have been illustrated and described in the living state and compared with normal cells of the same lineage by employing vital films and the phase contrast and bright field microscopes.

Various cytoplasmic structures, including cytoplasmic granules, Auer bodies, Kurloff bodies and "granule-vacuole" inclusions have been characterized both morphologically and cytochemically. These studies indicate the complex chemical nature of the cytoplasmic constituents of the cells of the hemopoietic system.

A technique is described for the visualization of masked lipids, which have not been demonstrated previously. It has been possible to demonstrate the lipid component of the cell nucleus with this method.

Consistently throughout this investigation, the cytochemical changes noted in normal development and maturation and in abnormal conditions resulting from disease and experimental treatment have been quantitative rather than qualitative.

177 pages. \$2.21. MicA 55-1246

THE DISTRIBUTION OF THE FIBERS IN THE SUPERFICIAL STRATUM OF THE DORSAL COCHLEAR NUCLEUS: (A QUANTITATIVE STUDY)

(Publication No. 11,851)

Ewart George Bertram, Ph.D.
University of Buffalo, 1954

The superficial stratum of the dorsal cochlear nucleus is a very thin layer of grey matter containing granula, stellate and fusiform cells. The granular cells are the most numerous and the fusiform cells are the least numerous. A single layer of ependymal cells covers the superficial stratum.

Using the various silver staining methods, studies of normal material reveal that the superficial stratum is a component layer of the dorsal cochlear nucleus as fibers and collaterals from the underlying areas reach into and terminate (synapse) in this layer. Possibly some collaterals from the cochlear nerve terminate here. Also some fibers from this layer course medially over the restiform body and merge with fibers from the underlying layer of the dorsal cochlear nucleus to form the dorsal acoustic stria.

Furthermore, normal studies show axons coursing in different directions. Many are parallel to one another and parallel to the external surface of the dorsal cochlear nucleus. Fibers from the superficial stratum innervate the ependymal cell layer.

In experimental animals, lesions placed in various areas of the superficial stratum serve as a very useful method for determining the distribution of the fibers in, and emanating from, the superficial stratum. Degenerating fibers can be followed and alterations in Nissl substance, changes in size of cell body and nucleus can be used as a means for indicating the course and distribution of the fibers under investigation.

The following morphological changes are produced in the neurons of the superficial stratum in experiments of short duration. Two days following the lesion chromatolysis is well established and reaches its peak at five days. Chromatolysis is found on each side of the lesion but is greater on the lateral side. At the same time, the cell bodies and nuclei enlarge, which is in keeping with the cells in axon reaction. In experiments of long duration cell atrophy and a loss of cells on each side of the lesion is found. Again, the greatest loss is found on the side lateral to the lesion.

Degenerating fibers are found on each side of the lesion; the greatest amount of degeneration is medial to the lesion. The fiber degeneration can be traced medially over the restiform body and there merges with fibers from the deeper strata in the dorsal acoustic stria. In animals in which deeper areas of the dorsal cochlear nucleus are involved, degenerating fibers from all strata can be followed via the dorsal acoustic stria into the lateral lemniscus. Degeneration fibers can also be traced from the underlying strata into the deeper portion of the superficial stratum of the dorsal cochlear nucleus. In the rostral portion of the dorsal cochlear nucleus,

degeneration fibers are followed into the floccular leaf of the cerebellum.

The superficial stratum is a component layer of the dorsal cochlear nucleus. It receives fibers and collaterals from the underlying layers of the dorsal cochlear nucleus. Fibers in this stratum (1) course medially to the dorsal acoustic stria and thence, to higher centers, (2) course medially to the flocculus of the cerebellum, and (3) innervate the ependymal cell layer. 110 pages. \$1.38. MicA 55-1247

**ELECTROPHYSIOLOGICAL STUDIES OF
CEREBRAL CORTICAL FUNCTION:
THE REGULATORY ROLE OF THE
SUPRAGRANULAR LAYERS IN THE
CONTROL OF INFRAGRANULAR
PYRAMIDAL CELL EXCITABILITY**

(Publication No. 11,997)

Jerome Sutin, Ph.D.
University of Minnesota, 1955

The technique of isopotential contour mapping has been employed to reconstruct the electrical fields evoked by afferent volleys throughout the depth of the cerebral sensory cortex and hippocampus. The cortical response to sciatic nerve stimulation and to activation through the fibers of the corpus callosum in rabbits under barbiturate anesthesia is a bipolar field of 10 msec. duration with the supragranular cortex positive and the infragranular cortex negative. A second type of response seen under more moderate depths of anesthesia consists, in addition to the bipole, of a subsequent negativity which ascends from the region of the granular layer to the cortical surface. Similar studies were undertaken in the hippocampus where a correlation of electrical activity with the neuronal structures underlying it is more readily made. The hippocampal response to afferent stimulation is also of two types. One type, seen with low intensity single stimuli is a bipole across the cell layer, the axonal aspect of the cell body being negative and the apical dendrite positive. A second

response, which may be correlated with the discharge of impulses over the efferent axons of hippocampal pyramidal cells, results if single high intensity or repetitive low intensity stimuli are used. These two potentials are designated the "excited state" and the "firing state" of the hippocampal pyramidal cell. The similarity of the hippocampal and isocortex pyramidal cells leads to the interpretation of the cortical response in light of the records obtained from the hippocampus.

The interaction of callosal and sciatic cortical responses throughout the depth of the cortex yields a conditioning curve showing maximal depression of the test response at 10 msec. response intervals, regaining full amplitude only with intervals greater than 140 msec. That this depression is not due to subnormality produced by the conditioning stimulus in a population of neurons common to both the test and conditioning responses is shown by experiments in which the conditioning response occurred a short distance from the site of the test response. It is concluded that separate populations of cortical neurons are activated by callosal and sciatic afferent impulses and that these have mutually inhibitory relations to each other.

Low intensity local stimulation of the cortex activates all or part of the supragranular layer. Conditioning with such a local stimulus and testing with a callosal or sciatic response results in a facilitation or inhibition of the test response. Facilitation is found at the edge of the area activated by the local stimulus, while inhibition of the test response occurs within this area. Isopotential contour maps show that conditioning activity confined to the supragranular cortex may affect the excitability of the infragranular cortex. A mechanism is proposed to explain these observations, whereby external current flow from supragranular pyramids flow through adjacent apical dendrites from deeper lying infragranular cells, thus altering the apical dendrite membrane potential and consequently the response of these deep cells. One consequence of this hypothesis is the expected release of the infragranular pyramids following inactivation of the supragranular cortex. Experiments are reported showing such a release.

188 pages. \$2.35. MicA 55-1248

ANTHROPOLOGY

CULTURE CHANGE IN CONTACT SITUATIONS: GENERALIZATIONS IN SYNTHESES BY MALINOWSKI, LINTON AND BARNETT

(Publication No. 11,913)

Ethel Nurge, Ph.D.
Cornell University, 1955

The research underlying this thesis was first envisioned as the abstraction and classification of some generalizations about culture change. As the study design developed and was tested by preliminary readings, it became clear that such an attempt was premature. Therefore a more modest plan was devised.

The statements about culture change in contact situations made by several major theorists were scanned. The works used were *The Dynamics of Culture Change* (B. Malinowski), the last three chapters of *Acculturation in Seven American Indian Tribes* (R. Linton), and Part IV of *Innovation* (H. G. Barnett). These works were subjected to detailed scrutiny with regard to the number and kinds of generalizations found. Eighty-one statements or series of statements were abstracted and each in turn was considered with reference to (a) concepts, (b) relationship between concepts, (c) universe and (d) degree of confidence.

The concepts were scrutinized and discussed as to their meaning, clarity, aptness, fruitfulness, and consistent usage. The relationships were judged for their explicitness and detail of qualification. Thirdly an attempt was made to determine the universe to which the statement applied. The statements were judged as to the degree of confidence which the original writer had in them and then the present writer rated them. Sometimes discussion and reformulation were attempted and techniques for testing were suggested.

An example from the thesis will illustrate some of these operations. Take the generalization:

If the members of the inferior group know that there is a genuine possibility for the ultimate removal of their social disabilities, they will put up with all sorts of hardships and even injustices, considering them transitory phenomena. (Linton)

From this generalization the concept "social disabilities," for example, was abstracted for comment. It was pointed out that the referents to social disabilities might include such disparate items as barriers to intermarriage, segregation of residence areas, exclusion from the more lucrative or prestigious statuses, and proscription of opportunity to modify self-concept through education, work experience, and the everyday, innumerable acts of social intercourse that build a personality. The purpose behind

enumeration of referents is to encourage the researcher to begin structuring operational definitions of the concepts to which they are referents. When operational definitions are achieved, they, in turn, will lead to the more accurate and complete description of the variables involved in the relationship stated in the generalization.

Following the discussion of concepts, there was an attempt to judge the universe or population to which the generalization applied. The universe could not be determined. In the next operation it was judged that Linton had a high degree of confidence in the generalization but that the present writer had only an intermediate degree of confidence. Finally it was suggested that it would be possible to secure data leading to the substantiation or modification of the generalization through the use of survey techniques.

All the generalizations were handled in a comparable manner.

The general findings of the thesis as a whole point up a need for greater rigor and precision in several areas: in the gathering of raw data, in the processing of field material, and in the framing of the generalization.

311 pages. \$3.89. MicA 55-1249

UNION PARTICIPATION: A STUDY IN CULTURE AND PERSONALITY

(Publication No. 11,915)

Seymour Parker, Ph.D.
Cornell University, 1955

This is a study of a group of economically impoverished men, living in a few small communities in the Maritime Provinces, Canada. Their failing attempt to form a trade union was studied as a problem in culture and personality. The purposes of the study were threefold:

1. To examine the relationship between a socio-cultural environment and the personalities of the individuals that live within it.
2. To examine eight hypotheses concerning the components of organizational morale.
3. To study the relationship between personality and the acceptance or rejection of cultural innovations.

In the early chapters, a socio-cultural description of the area is presented. This places in proper context the responses to a questionnaire that was administered to a sample of 46 union members (out of a total of 114). The sample was divided into two sub-samples consisting of the active union members and the inactive union members. Their responses were examined in order to shed light on the morale hypotheses and to ferret out attitudinal differences between the groups.

Following this, four life histories – two of active and two of inactive members – were presented and analyzed in order to examine some of the relationships between personality and culture and to gain further insight into organizational morale. For each man a chart was drawn that demonstrated diagrammatically the interrelationships between his self-system, his sentiments, his current equilibrium, and his attitudes toward the trade union.

The questionnaire responses indicated that the active and the inactive members were distinguished by both attitudinal and overt behavioral differences. The former group had a higher level of education, had greater occupational skills, had more favorable attitudes towards their fellow employees and their neighbors, visited with others more frequently, and attended church more often. In general, the inactives were characterized by apathy, loss of self-esteem, small capacity to relate to others, and a drastic lowering of goals. An examination of our hypotheses indicated that an understanding of morale involves a knowledge of both intra-organizational and extra-organizational factors. The adjustment that an individual makes in his social environment affects his reaction to the trade union.

Our life history analysis pointed to the following:

1. In most cases an individual's organizational morale consists of both negative and positive attitudes.

2. Sentiments toward the union (or any other sentiments) may be regarded as existing in a functional relationship to an individual's self-system, other sentiments, and current social equilibrium. It is enmeshed in a complex balance of these three elements, and plays a functional role in the total adjustment of the organism.

3. Forces of security and support in one's current social equilibrium may lead to either negative or/and positive union sentiments. The same can be said of the forces of insecurity.

4. There is little specificity between an individual's self-system (i.e., core personality traits) and his institutional behavior. In order to understand or predict the latter one must know the person's sentiments and current social equilibrium, as well as his self-system.

Our conclusions concerning the acceptors of cultural innovations point to the fact that, contrary to some of the literature on the subject, those who are most socially marginal in their communities are the least likely to accept cultural innovation. They are too apathetic for sustained affirmative action.

A further conclusion of our study is that it tends to support the view that personality and culture are merely two ways of regarding and abstracting human behavior. 363 pages. \$4.54. Mic 55-124

ASTRONOMY

A STUDY OF STELLAR SCINTILLATION

(Publication No. 12,183)

William Mansel Protheroe, Ph.D.
The Ohio State University, 1955

A study of stellar scintillation has been made by the use of the harmonic analysis technique. The present study differs from previous studies in that a magnetic tape recorder has been utilized in order to assure homogeneous samples of scintillation throughout an entire frequency analysis.

The equipment and circuitry used in the measurements along with the observing and reduction technique are described. It is demonstrated that the uncertainty in the scintillation exceeds the probable error inherent in the equipment by a considerable factor.

The results based upon 635 observations made over a period of 18 months are presented in terms of various parameters affecting the amount of scintillation detected from a star. The parameters discussed are zenith distance, aperture, source size (multiple stars and planets), meteorological factors, and spectral region. Daytime and nighttime scintillation are also contrasted.

The upper air winds are the only meteorological factor which it has been possible thus far to correlate

with stellar scintillation, the correlation at the 200 mb level being best. The wind direction, but not its sense, shows a scatter of about $\pm 6.7^\circ$ and the velocity about ± 14 knots when compared with available meteorological data. It is shown that the seasonal variation found in stellar scintillation by Mikesell of the Naval Observatory can be explained on the basis of the seasonal change in the 200 mb winds.

Empirical formulae are presented for the change of scintillation as a function of zenith distance for four aperture sizes, 12.5-, 6-, 3-, and 1-inch. The scatter evidenced in the data taken on many different nights is shown to be related to variations in the 200 mb level winds.

It is shown that the spectral dependence of scintillation over a wave-length interval of 3600 angstroms is very small. The effect of color scintillation evident to the eye is probably due to general atmospheric refraction.

The comparison between daytime and nighttime scintillation shows that the daytime scintillation exceeds that at night by a factor of 2 at the most and has a Fourier spectrum almost identical with the nighttime scintillation.

The manner in which the amount of scintillation changes with telescope aperture from one- to 12.5-inches is demonstrated. This change with aperture size is shown to be a function of the winds at the 200 mb level.

The extended and multiple source study, while quite limited, shows that the amount of scintillation received from a double star or from a planet has a different aperture effect from that received from a single star. The measurements indicate that while it may be possible to derive the same amount of scintillation from a planet observed with a small aperture as from a star observed with a large aperture, the frequency distribution of the noise components is not necessarily the same. The double star measurements indicate that there is some sort of "phasing" relationship between the signals from the component stars considered individually.

A correlation between seeing and scintillation was

attempted. The only positive correlation which could be made with present data is between the image size accompanying large amounts of scintillation.

The autocorrelation functions of the shadow band patterns on three nights in March, 1954, were determined from scintillation measurements. The patterns on these nights showed a restricted element size, about 5 to 10 inches. The patterns also showed a preferred direction of motion along that of the 200 mb level and a correlation with the magnitude of the velocity at that level. Furthermore, the pattern elements were elongated in the direction of motion.

204 pages. \$2.55. MicA 55-1250

BACTERIOLOGY

ANTIGENICALLY MODIFIED ERYTHROCYTES IN CHICKENS INFECTED WITH NEWCASTLE DISEASE

(Publication No. 12,169)

Edward Gardner, Jr., Ph.D.
The Ohio State University, 1955

Antigenic changes produced in erythrocytes following the adsorption and elution of certain hemagglutinating viruses have been considered in several recent investigations. It has been postulated that alterations of red cells *in vivo* by the action of bacteria and viruses might result in autoimmunization, and this phenomenon has been proposed for the appearance of incomplete antibody in hemolytic anemia. This investigation was performed in an attempt to demonstrate these phenomena in chickens experimentally infected with Newcastle disease virus.

Antisera to chicken erythrocytes were prepared after exposure to the hemagglutinating action of influenza and Newcastle disease virus as well as to normal erythrocytes by the immunization of rabbits. The antisera were then absorbed with homologous and heterologous cells by appropriate methods.

Groups of 3- to 6-week-old chickens were infected with Newcastle disease by the injection of various amounts of virus by different routes. In addition, a simulated natural infection was accomplished by placing uninoculated birds in pens with infected chickens.

Determinations of the presence of modified erythrocytes in the infected chickens were made by the use of a monospecific antiserum obtained by the absorption of antiserum to chicken erythrocytes treated with NDV *in vitro* with normal cells and cells treated with influenza virus. Serum samples were also collected from infected and control animals in order to test for agglutinins to NDV-modified erythrocytes and hemagglutinin-inhibiting antibody.

Antigenically modified erythrocytes were detected in chickens infected by the intracardial, intraperitoneal, intranasal, and intraocular routes, as well as in

chickens which had been infected as a result of contact with diseased animals. Highest titers were obtained with red cells 12 to 24 hours after infection from chickens receiving the virus by the intracardiac route. Egg inoculations in which whole blood from the infected animals was used revealed that a viremia was present when the blood was first tested at 24 hours and persisted until the 5th day. Therefore, modified cells were demonstrable after the disappearance of detectable virus from the circulation. Repeated attempts to detect modified cells in chickens infected by intramuscular inoculation failed, although subsequent tests on the serum of these animals showed significant amounts of agglutinins for modified cells, which indicates the probability that undetected modification had occurred. The injection of large amounts of virus into immune animals did not result in the detection of modified cells.

Modified cell agglutinins were detected in all animals infected by the different routes employing chicken erythrocytes treated with NDV *in vitro*. Highest titers were obtained between the 5th and 6th days, and agglutinins were still present at low levels as long as 37 days after the initial infection. Hemagglutinin-inhibiting antibody was present on the 5th day after infection, increased to a maximum in approximately 3 weeks, and was present in high titers at the end of the test period.

Virus-treated red cells have been shown to be more susceptible to phagocytosis by macrophages in tissue culture. Confirmation of the above results were obtained with this method by the use of red cells of chickens infected with Newcastle disease virus. Phagocytic indexes for such cells were increased during the time modified cells were detected with specific antiserum.

These results indicate that Newcastle disease in chickens may be accompanied by an antigenic change in the red cells sufficient to instigate a process of autoimmunization resulting in the presence of hemagglutinins in the serum of the survivors for red cells treated with this virus *in vitro*. This antibody was

separated from antibody to the virus. Only limited hematological examinations were performed, and the possibility that hemolytic phenomena accompany these processes requires further study.

70 pages. \$1.00. MicA 55-1251

STUDIES THAT CONCERN MEASUREMENTS OF POLIOMYELITIS VIRUS SYNTHESIS IN STRAIN HELA CELLS

(Publication No. 11,978)

George Edwin Gifford, Ph.D.
University of Minnesota, 1955

Major Adviser: Dr. Jerome T. Syverton

Ethionine, benzimidazole, pyridine-3-sulfonic acid, desthiobiotin, homobiotin, pantoyl taurine, 2,6-diaminopurine, β -2-thienylalanine, 3-acetyl pyridine, desoxypyridoxine, colchicine, methionine sulfoximine, and histamine dihydrochloride did not inhibit the synthesis of poliomyelitis virus, Type 1, Mahoney strain, in stationary strain HeLa cell cultures except at concentrations which were toxic to host cells as judged by altered morphology. Equivocal inhibition occurred in cultures which showed doubtful evidence of toxicity. In no case was there any evidence of delayed cytopathogenicity due to the addition of a chemical agent.

Benzimidazole, β -2-thienylalanine, 2,6-diaminopurine, DL-ethionine, pyridine-3-sulfonic acid, DL-desthiobiotin, and furfural did not inhibit the synthesis of poliomyelitis virus, Type 1, strain Mahoney, in shaken strain HeLa cell cultures except at concentrations which were markedly inhibitory to the respiration of the host cell. Cessation of respiration of infected cultures occurred at the same time independent of the concentration of added chemical agents employed or of the final titer of virus. The ethionine-induced inhibition of respiration was only partially reversed by the addition of methionine. A concentration of benzimidazole, 0.25 mg./ml., which was not toxic for HeLa cells, as assessed by microscopic observations of altered morphology, was markedly inhibitory to the respiration of cells in a Warburg vessel.

Phosphite or phosphate, 0.02 M., and tris(hydroxymethyl)aminomethane, 0.01 M., were shown to be non-toxic for strain HeLa cells for a period of 72 hours. Phosphite, 0.02 M., was shown to be a useful supplementary buffer for those systems in which the pH rapidly decreased.

Hanks's balanced salt solution was found to replace maintenance solution in strain HeLa cell cultures for an interval of up to at least 72 hours without any decrease in the respiration of the cells. Parker's synthetic medium No. 703 (for strain L cells) was demonstrated to be no better than Hanks's balanced salt solution for maintaining strain HeLa cells.

Chicken serum, 20 per cent by volume, resulted in slight increase of oxygen uptake with time to indicate that cell multiplication occurred. The presence

of 10 per cent chicken serum resulted in an almost uniform uptake of oxygen over an interval of 72 hours.

A comparison of the respiratory rate of strain HeLa in the presence of various concentrations of serum was made. The results indicated that the rate of increase in respiration with increasing levels of serum decreased with each added increment of serum. There was no significant increase in respiratory rate for the addition of greater than 40 per cent serum for an interval of 72 hours. The increase in respiration with increase in serum level was found to be independent of the increase in glucose which resulted from the increase in serum content.

The total oxygen uptake and virus synthesized was found to be essentially the same in stationary and shaken cultures.

The importance of the oxidative energy of respiration for the synthesis of poliomyelitis virus, Type 1, Mahoney strain, by strain HeLa cells was demonstrated. Anaerobically, such cells were able to produce less than 0.01 per cent of the amount of virus produced by replicate systems under aerobic conditions.

The advantages of a homogeneous cell culture over mixed cell cultures for studies of chemical inhibition of virus synthesis are discussed. Cellular uniformity permits precise allocation of the observed effects of a test agent to cells capable of propagating the virus.

77 pages. \$1.00. MicA 55-1252

EFFECT OF CORTISONE ON COXSACKIE VIRUS INFECTIONS

(Publication No. 11,853)

Henry J. Hearn, Jr., Ph.D.
University of Buffalo, 1955

Experiments were carried out, the results of which demonstrated the effect of Cocksackie Group A virus alone, cortisone alone, and both virus plus cortisone on mice of different age groups. It was shown that suckling mice were uniformly susceptible to virus and unaffected by relatively large amounts of cortisone, in addition to which cortisone failed to increase the adverse effect of the virus infection. It was shown that weanling mice were partly susceptible to large doses of virus and that cortisone itself caused death, especially in doses of 2.5 mg. or more. Doses of less than 2.5 mg. cortisone caused an enhanced lethal effect from virus on 9-10 gm. mice. It was shown that young adult mice were insusceptible to clinical symptoms when injected with virus alone, and relatively free from a lethal effect of cortisone alone. Cortisone given at close intervals with Cocksackie virus enhanced the effect of virus in mice of this age by causing paralysis, 10-100 fold increase in virus concentration, and greater muscle degeneration with little or no repair in leg muscles. Two experiments showed that when mice were given cortisone throughout one week prior to injection of the virus, i.e., as a "pretreatment", no increase in virus

concentration, paralysis or muscle degeneration occurred.

Young adult mouse leg tissues were divided into four groups on the basis of the treatment each animal received as follows: Virus and cortisone; virus alone; cortisone alone; and normal tissue. They were examined for pyruvic dehydrogenase and xanthine oxidase activity, virus content, and microscopic lesions. The greatest activity of pyruvic dehydrogenase and xanthine oxidase was present in tissues of animals which received virus and cortisone. This was followed by tissues of animals which received cortisone alone, virus alone, and finally normal tissue. The greatest enzyme activity was found at the early post injection period with one major exception. The greatest concentration of virus in the leg tissue was similarly found at the early post injection period. These findings reflect the animal's active response immediately following injection and subsequent return to normal within two to three weeks. An unexpected development concerned tissue of animals which received cortisone alone. It showed surprisingly high activity of both enzymes.

The maximum concentration of Coxsackie virus in tissues of animals injected with virus and cortisone did not exceed the maximum concentration of virus in tissues of animals injected with virus alone. In the former case, however, once the maximum was attained, it was sustained for much longer a time than in tissues of animals injected with virus alone. There is apparently a close correlation between the activities of both enzymes and the concentration of virus in leg tissue particularly of animals which received virus and cortisone. The one major exception, which was discussed, was the pyruvic dehydrogenase activity of tissue from animals injected with virus alone.

Attempts were made to shed some light on the possible mechanisms by which cortisone affected Coxsackie virus infections. The inhibition by cortisone of the host defense mechanisms was certainly an evident feature, probably in the form of interference with the reticuloendothelial system. The question was raised as to whether the increased enzyme activity of cells caused by cortisone may indicate the increased metabolic rate of the cells, and thereby offer an added inducement to the multiplication of virus. This may have accounted in part for a longer retention of virus in the cortisone-treated tissues resulting in the increased leg muscle degeneration seen in our Coxsackie virus infections. Finally, experimental evidence was presented to demonstrate the possibility of cortisone's stirring up latent agents in laboratory animals which may interfere with the experimental infection.

56 pages. \$1.00. MicA 55-1253

SOME ASPECTS OF THE INDUCED BIOSYNTHESIS OF THE ALPHA-AMYLASE OF *PSEUDOMONAS SACCHAROPHILA*

(Publication No. 12,133)

Alvin Markovitz, Ph.D.
University of Washington, 1955

A method for the purification and crystallization of the alpha-amylase of *Pseudomonas saccharophila* has been presented. Electrophoretic and ultracentrifugal studies of the purified enzyme indicate that the protein is homogeneous with respect to molecular size and charge.

Some properties of the extracellular alpha-amylase have been studied. The optimum pH of enzymatic activity, the Michaelis constant (K_m), the optimum pH range of stability, the energy of activation, the ultraviolet absorption spectrum, the amino acid composition, and the inhibitory action of versene have been studied.

The induced biosynthesis of the alpha-amylase in growing and resting cells has been studied. Certain optimal conditions for the induction in growing and resting cells have been determined. The kinetics of the enzyme biosynthesis has been shown to be linear. The induced biosynthesis of the alpha-amylase has been shown to be inhibited by varying concentrations of sodium arsenate, sodium azide, and 2,4-dinitrophenol in resting cell suspensions.

The induced biosynthesis of alpha-amylase in resting cell suspensions has been shown to be stimulated by the addition of acid-hydrolyzed casein or ammonium chloride, the latter compound being more efficient as a nitrogen source for this organism.

Optimal conditions for the induced biosynthesis of sucrose phosphorylase have been determined.

The induced biosynthesis of either alpha-amylase or sucrose phosphorylase in resting cells was shown to inhibit the subsequent induction of sucrose phosphorylase or alpha-amylase, respectively. It was also observed that the induction of alpha-amylase subsequent to the induction of sucrose phosphorylase did not cause any decrease in sucrose phosphorylase of such cells. The induction of both enzymes at the same time caused a decreased synthesis of both enzymes.

In a growing cell experiment, using isotopically labeled cells, it was shown that a small but significant portion of the alpha-amylase was synthesized from pre-existing carbon compounds.

With C^{14} -labeled cells it was shown that in resting cells about 65% of the carbon for the induced biosynthesis of alpha-amylase comes from carbon compounds of the cell.

Using C^{14} -labeled starch it was shown that, in resting cells, approximately 39% of the enzyme carbon comes from the substrate.

A free amino acid and peptide pool was demonstrated in *Pseudomonas saccharophila* and some data on its composition given.

143 pages. \$1.79. MicA 55-1254

STUDIES ON EGG WASHING AND PRESERVATION

(Publication No. 12,153)

Tawfik Younis Sabet, Ph.D.
Michigan State University, 1955

Present-day methods of egg washing have been more or less condemned because of increased susceptibility to microbial invasion. This increased susceptibility of eggs to spoilage presents a major problem in cold storage, especially with regard to increasing egg production.

It is the purpose, then, of this work to develop a method of egg washing which will properly clean the egg, prevent microbial invasion, and at the same time retain the physiochemical properties.

During the course of this work, two artificial soils were developed as a means of determining the relative efficiency of various surface-active detergents.

Through experimentation *Pseudomonas aeruginosa* proved to be the most suitable organism available for this type of study. This was determined by three testing procedures devised by the author. These testing methods may also have application in future work of this nature.

As a consequence of experimentation concerning the original problems, an oil-in-water emulsion was successfully prepared. This oil-in-water emulsion can be used to achieve a one-step operation for washing, sanitizing, and preserving eggs. By treating eggs with this emulsion, their microbial sterility and physiochemical properties can be adequately preserved.

It is hoped that this oil-in-water emulsion will find application and will be of value to the egg industry and its various ramifications.

121 pages. \$1.51. MicA 55-1255

STUDIES ON THE BIOLOGICAL SYNTHESIS OF CELLULOSE BY *ACETOBACTER XYLINUM*

(Publication No. 12,092)

Jerry Skopek, Ph.D.
University of Maryland, 1955

Supervisor: Dr. Norman C. Laffer

A study on the metabolism of *Acetobacter xylinum* was made as it relates to the synthesis of cellulose. It was determined that this organism possesses two oxidative mechanisms. By manometric techniques, it was determined that ethyl alcohol and glucose are rapidly oxidized. Carbohydrates (except glucose), polyhydric alcohols, and the intermediate compounds of the tricarboxylic acid cycle are not readily oxidized. Ethyl alcohol or inorganic phosphate, or their combination, did not significantly increase respiration with these latter compounds. Dehydrogenase enzyme activity with carbohydrates and polyhydric alcohols was demonstrated by the Thunberg technique. The

methylene blue was alternately reduced and oxidized, and particles of cellulose were formed. This activity was observed to take place for three days, both aerobically and anaerobically. The dehydrogenase activity was slightly stimulated by ethyl alcohol. It was inhibited by inorganic phosphate and adenosine triphosphate.

It was demonstrated that *A. xylinum* can convert a number of carbohydrates into cellulose in an asparagine synthetic medium. D-fructose, D-mannitol, D-glucose, and glycerol gave highest yields. Membrane formation did not result with DL-glyceraldehyde, D-glucosamine, and alpha-D-methylglucoside.

By filter paper partition chromatography, dihydroxyacetone was determined as a common intermediate compound when glucose, fructose, and glycerol were utilized. It was always found in small amounts in young cultures (up to 48 hours old), but was not detected by this technique in cultures 7 days of age.

An explanation of the synthetic process is proposed.

(1) Carbohydrates and polyhydric alcohols are converted to ketose sugars. The beta configuration results through a resonance of bonds between carbon atoms 1, 2, and 3 (Lobry de Bruyn Transformation).

(2) A ketone group is formed in position 5 as a result of dehydrogenation in that position.

(3) A proposed intermediate compound, 2,5 diketohexose, is formed as a result of the bond resonance and dehydrogenation. This compound can cleave to form two molecules of dihydroxyacetone. Conversely, it can be formed from two molecules of dihydroxyacetone.

(4) Either extremity of the molecule can result in the beta-configuration of glucose. Under enzyme control, the molecules can polymerize by an aldol condensation type of reaction. The hydrogen necessary for this reaction is supplied by the enzymes which were reduced by the dehydrogenation reaction.

(5) The stable amylose oxide ring is formed in the glucose molecule as a result of intramolecular forces. As a result, the point of attachment between molecules is directed to position 4. Thus, the beta-1,4 linkage of the cellulose molecule is affected by the reactive beta-aldehyde group in position 1 of one molecule and position 4 of another.

The synthesis of cellulose appears to serve two functions.

(1) The process furnishes energy and can maintain the organism under low oxygen tension.

(2) The membrane plays a role in the symbiotic relationship of this organism and fermentative yeasts in nature. The membrane, which contains the aerobic bacterium, provides the anaerobic conditions favorable to the yeasts for production of ethyl alcohol, which is readily metabolized by *A. xylinum*.

81 pages. \$1.00. MicA 55-1256

BASIC, BUTANOL-SOLUBLE ANTIBIOTICS FROM ACTINOMYCETES

(Publication No. 11,664)

Walter Thomas Sokolski, Ph.D.
Purdue University, 1955

Major Professors: Henry Koffler and P. A. Tetrault

This study deals with antibiotics from actinomycetes that are basic and soluble in butanol. Due to similarities in solubility, some antibiotics with these properties are difficult to separate by paper chromatography involving the usual organic solvents (e.g. lower alcohols). An effort therefore was made to find solvent systems that would separate some of the antibiotics from others within this group. Several systems were found to be useful in that respect. For instance, with a solvent system consisting of n-nonanol, carbon tetrachloride, and propionic acid (in the ratio of 75:75:2 by volume) the separation of erythromycin, an antibiotic produced by *Nocardia gardneri* (a proactino-mycin-producing strain), methymycin, and carbomycin from each other was obtained. The Rf values observed were .27, .39, .56, and .71 respectively.

An antibiotic produced by *Streptomyces* sp. 10 CM (Purdue) was studied. The following results were obtained in a "chemical screen" of the filtered fermentation beer: Antibiotic 10 CM was adsorbed more readily from alkalized beer than from acidified beer; the antibiotic was adsorbed on Amberlite IRC-50, and could be eluted from the resin with acid-ethanol (0.1 N HCl in ethanol); the solubility coefficient of the antibiotic (organic solvent/water) was greater at an alkaline pH than at an acid pH; there was no loss of activity in the filtered beer at pH 2.5 after 15 minutes at 100°C; 90% of the activity was lost with the same treatment at pH 9.2.

Extraction of antibiotic 10 CM in the crude form was accomplished as follows: *Streptomyces* sp. 10 CM was grown in shake flasks on a reciprocal shaker at 120 4-inch strokes per minute and 26°C in a medium composed of peptone, 5 gm; Cerelease, 5 gm; beef extract, 2 gm; malt extract, 2 gm; and yeast extract, 2 gm per liter of tap water. After a period of fermentation of 2 to 4 days, the whole beer was adjusted to pH 2 with 12 N hydrochloric acid and filtered. Some impurities were removed with 0.5% activated carbon. The filtrate was adjusted to pH 8, and the activity was adsorbed onto 0.5% activated carbon. The carbon was removed and washed twice with water and once with ethanol. The activity was eluted from the carbon with 0.1 N hydrochloric acid in ethanol. The eluate was evaporated *in vacuo* to an active brown hygroscopic solid. The yield was approximately 0.5 gm per liter of whole beer. This crude material inhibited the growth of *Bacillus subtilis* NRRL B971 at a concentration of 2 mcg/ml. The LD₅₀ (by the intravenous route) for white mice was between 500 and 700 mg/kg.

A two-fold purification of the crude extract was accomplished by means of column chromatography. The adsorbent was a 1:1 mixture of Celite and

activated carbon, and the developing solvent was ethanol. The active fractions were combined and evaporated *in vacuo* to a light brown hygroscopic solid. The "purified" extract inhibited the growth of *Bacillus subtilis* NRRL B971 at a concentration of 1 mcg/ml.

The antimicrobial spectrum of "purified" antibiotic 10 CM was determined *in vitro* by broth dilution tests with bacteria and yeasts and by agar dilution tests with molds. The following concentrations were tested: 0.01, 0.1, 0.5, 1, 2, 10, 25, 50, 100 mcg/ml. The inhibiting concentration was determined as the lowest concentration in the dilutions tested that completely inhibited the growth of the test organism after 18 hours of incubation (molds were incubated for 5 days). A few of the organisms tested are listed in Table 1.

Table 1. *In vitro* antimicrobial spectrum of antibiotic 10 CM.

Test organism	Concentration of 10 CM mcg/ml
<i>Bacillus subtilis</i> NRRL B971	1
<i>Bacillus subtilis</i> NRRL B972	>100
<i>Micrococcus pyogenes</i> var. <i>aureus</i> 209P	1
<i>Micrococcus pyogenes</i> var. <i>albus</i>	1
<i>Sarcina luteae</i> Purdue	0.1
<i>Neisseria catarrhalis</i>	1
<i>Escherichia coli</i> ATCC 26	25
<i>Aerobacter aerogenes</i> Purdue	>100
<i>Klebsiella pneumoniae</i>	5
<i>Salmonella schottmuelleri</i> Squibb	50
<i>Vibrio cholerae</i>	1
<i>Mycobacterium</i> sp., 3 strains	50
Molds, 5 species	>100

Paper chromatography was used to differentiate antibiotic 10 CM from other basic, butanol-soluble antibiotics. The antibiotics were spotted on the paper alone and in mixtures. Separation of 10 CM from erythromycin, carbomycin, methymycin, amicetin, griseomycin, and an active extract from a culture of *Nocardia gardneri* (proactinomycin-producer) was accomplished. 198 pages. \$2.48. MicA 55-1257

THE DEVELOPMENT OF EXPERIMENTAL MEDIA FOR ISOLATION AND CULTIVATION OF MYCOBACTERIUM TUBERCULOSIS

(Publication No. 12,157)

Joseph Wilson Whalen, Ph.D.
Michigan State University, 1955

The studies described were undertaken to develop simply prepared culture media, the use of which would facilitate recognition and removal of colonies of *Mycobacterium tuberculosis*, as well as supporting rapid and profuse growth of this organism.

Original formulations of experimental media were compared with the Dubos-Davis and Petragnani media. Modifications were effected through addition or removal of 1 ingredient, and were compared with the above media, as well as others conventionally used for isolation and cultivation of tubercle bacilli. Evaluation was through comparison of both the time required for detection of visible growth and the ultimate extent of growth from inocula consisting of either pathological specimens or suspensions of *M. tuberculosis*. Generation time determinations, as well as turbidometric and micro-Kjeldahl growth rate measurements, were also used.

Among the many types of media developed and studied, several were considered satisfactory. Earlier appearance of growth and a greater number of positive cultures were obtained on an experimental egg medium than on the Petragnani medium. Two agar media supported faster growth of tubercle bacilli than the Dubos-Middlebrook oleate-albumin agar. The highest number of positive cultures and the most rapid growth of *M. tuberculosis* from sputum specimens were obtained with ethyl violet-sodium azide liquid media when they were compared with the Dubos-Davis medium and the Loewenstein-Jensen, Petrick, Petragnani, and Peizer egg media. A much larger number of positive cultures was secured from sputa of patients receiving streptomycin - para-amino salicylic acid therapy with ethyl violet-azide than with the other media. Contamination of these experimental media was less than with the Dubos-Davis medium, but greater than with the egg media. In the presence of ethyl violet, aggregates and colonies of tubercle bacilli are blue-violet. This typical color aided detection and differentiation of growth, but contaminating streptococci, forming purple colonies, sometimes masked it.

The use of sodium azide in experimental media

was subsequently discontinued because of its toxicity for *M. tuberculosis*. Contamination of ethyl violet media was effectively suppressed by using penicillin and acti-dione as additional selective agents.

Tubercle bacilli grow in characteristic blue-violet colonies on the surface of glass wool in ethyl violet culture media. Colonies are light pink in neutral red media and a more brilliant pink in Sudan IV oleate media. The formation of Sudan oleate-albumin complexes made it possible to use fat soluble dyes in media.

Ethyl violet, neutral red, ethyl violet - neutral red, and Sudan IV oleate liquid experimental media in glass wool flasks, and the Petragnani medium were employed to isolate *M. tuberculosis*. Colonies of tubercle bacilli were detected on the Sudan IV oleate medium after an average of 8 days incubation. Earliest detection was on this medium because of the distinctively vivid colony color and more rapid multiplication of the organism. Colonies of saprophytic mycobacteria can be differentiated from those of *M. tuberculosis* on neutral red and Sudan IV glass wool media.

One grade of activated charcoal, when incorporated in an agar medium, stimulated growth of tubercle bacilli as much as did human serum and oleic albumin. Additional generation time studies and routine cultural use established that a 1 to 400,000 concentration of ethyl violet is the optimum selective concentration for this medium. In culturing pathological material, inclusion of 100 units of penicillin and 100 micrograms of actidione per ml further reduced contamination. A greater and more rapid recovery of *M. tuberculosis* was achieved with the charcoal medium. It is easily prepared, since sterilization is by autoclaving. Addition of filter-sterilized enrichments is unnecessary.

173 pages. \$2.16. MicA 55-1258

BIOGRAPHY

THE LIFE AND WORKS OF ADRIEN BAILLET

(Publication No. 12,074)

Leonard Judah Wang, Ph.D.
Columbia University, 1955

This study was undertaken to shed light on the life and works of one of the most interesting French erudites of the second half of the seventeenth century. A Cartesian and a Jansenist, Adrien Baillet was born of peasant parents in the Picard village of La Neuville on June 13, 1649. After receiving his early education at a village school and at a monastery of Franciscan monks, he studied the humanities at the Little Seminary of the Jansenist bishop of Beauvais. From 1672-1675 Baillet taught at the Little Seminary, relinquishing his post in 1675 to enter the bishop's divinity school where he was ordained a priest in

1676. After serving in the parishes of Lardières and Beaumont from 1677-1680, he was appointed in 1680 librarian and preceptor in the house of the distinguished magistrate Chrétien-Francois de Lamoignon. Baillet remained with Lamoignon for the rest of his life.

In 1685-1686 he launched his literary career by publishing the first parts of his *Jugemens des savans*, a composition calculated to evaluate the principal works composed in all fields of human endeavor since earliest times as well as the judgments of their critics. No further parts of this work were ever published. Baillet published a detailed *Plan of the Jugemens* in 1694. The most representative of Baillet's compositions, the *Jugemens* reveals his Cartesianism, Jansenism, and Gallicanism, as well as his interest in progress and pedagogy and his passion for composing compendiums of systematized knowledge.

The freedom with which he criticized the authors of his century in the *Jugemens* earned Baillet many enemies, the most intransigent of whom were the Jesuits who attacked his maiden work sporadically from 1685-1691, and Gilles Ménage who published a two volume *Anti-Baillet* in 1688. Baillet answered these attacks in the prefaces of Part II of the *Jugemens* (1686) and in the treatise *Des Satyres personnelles, traité historique et critique de celles qui portent le titre d'ANTI* (1689).

In 1688 Baillet published *Des Enfants devenus célèbres par leurs études & par leurs écrits* in which he inveighed against those of his contemporaries who held that serious learning was inimical to the sanity and physical welfare of the young, and proposed a program of study for children which is in many ways consistent with those of Montaigne and the writers of Port-Royal. Two years later he published *Des Auteurs déguisés* in which he disclosed the reasons which impelled authors to assume names other than their own and the methods by which this was accomplished.

Between 1690 and 1693 Baillet wrote *La Vie de Monsieur Des-Cartes* (1691), one of the most substantial and authoritative biographies of Descartes ever written, which was criticized adversely by an anonymous Jesuit, Huet, Leibniz, and Malebranche; *La Vie d'Edmond Richer* (1692), a justification of the early

seventeenth-century Gallican theologian which was published posthumously; a voluminous *Histoire de Hollande depuis la trêve de 1609, où finit Grotius jusqu'à notre tems* (1693); and probably the *Histoire des démeslez du pape Boniface VIII avec Philippe Le Bel roy de France* which was published posthumously, and in which he defends Philip and the French Gallican Church against Boniface.

Between 1693 and 1704 Baillet composed *La Vie de Godefroy Hermant* (1701), a biography of his spiritual director which was published posthumously; a French translation of the maxims and teachings of Saint Etienne de Grandmont (1704); and three provocative theological works: *De La Dévotion à la Sainte Vierge* (1693) in which he censured the idolatrous and superstitious practices in the cult of the Virgin, and which, after a stormy controversy, was put on the Index; *De La Conduite des âmes* (1695) in which he discussed the relation between a spiritual director and his parishioners, and reproved any abuses found in that relation; and a monumental *Vies des saints* (1701-1703) in which he demolished many popular traditions, legends, and fables concerning the lives of the saints, and rejected or cast doubt upon all miracles not corroborated by the most trustworthy sources. Baillet died on January 21, 1706 - three years before the *Vies des saints* was put on the Index.

298 pages. \$3.73. Mic 55-125

BIOLOGY - GENETICS

POLLINATION AND INCOMPATIBILITY
STUDIES IN *SOLANUM TUBEROSUM* L.

(Publication No. 11,894)

Darrel Rudolph Bienz, Ph.D.
Cornell University, 1955

This study was undertaken to attempt to find some of the reasons for the failure of potato clones to set fruit in a potato breeding program conducted in the greenhouse. The conclusions are based on a study of the effect of a number of environmental factors and pollinating techniques on all possible crosses among seven potato clones.

The percentage of fruit set and the seeds per fruit were greater for flowers pollinated just after they had opened than for those pollinated in the bud stage, although some fruit set on flowers pollinated at maturity levels of from '48 hours before they opened' until '96 hours after they had opened.' When high temperatures occurred on several consecutive days, fruit set was reduced, but there was little reduction when high temperatures lasted for only one day.

The position of the flower in the cluster and the morning hour at which the flower was pollinated did not affect fruit set and evening pollination was as successful as morning pollination. From the evidence

available, emasculation does not appear to be necessary in a breeding program.

Pistils from four crosses were examined cytologically in an effort to determine differences which might account for the failure of fruit set with incompatible crosses and with bud pollination. For the incompatible crosses, failure of fruit set could be attributed to fewer pollen grains adhering to the stigma, a smaller percentage of these germinating and the failure of pollen tubes to penetrate to the ovules. Fewer pollen grains adhered to the stigmas and a smaller percentage of these germinated with bud pollination than with pollination after the flower had opened. Abnormal pollen tubes of the types generally associated with the presence of incompatibility alleles were found in the styles of both compatible and incompatible crosses.

A breeding program based partly on the results of this study is described. From the evidence available, it is concluded that the potato possesses incompatibility factors of the oppositional type.

141 pages. \$1.76. MicA 55-1259

THE POLLINATION OF BIRDSFOOT TREFOIL (*Lotus corniculatus* L.)

(Publication No. 11,911)

Roger A. Morse, Ph.D.
Cornell University, 1955

Birdsfoot trefoil is playing an increasingly important role on New York State farms. Seed yields have varied considerably and it has been thought that part of this variance was due to a lack of pollination or pollinating insects. This study deals with the pollination requirements of the plant.

1. Honeybee populations of one bee per square yard or slightly less than one bee per square yard are sufficient to pollinate all birdsfoot trefoil flowers in the Ithaca area and presumably much of New York State. Where the honeybee population is less than this, it would be advisable to add more bees to the area.

2. Such a population permits all flowers to be visited from 12 to 25 times during the flowering period, and does not allow the flower to accumulate large reserves of nectar. For this reason bee visits to flowers average 4 to 5 seconds, allowing bees to visit about 12 flowers a minute.

3. Birdsfoot trefoil competes well, insofar as sugar concentration in the nectar is concerned, with other honey plants, and competition is not a severe problem.

4. One bee visit of short duration (4 to 10 seconds) can bring about pollination to the extent that the maximum number of seeds are produced. However this does not always happen, and more visits seem to be necessary to insure that a majority of the flowers produce seed pods.

5. Under caged conditions bee populations of from 4 to 7 bees per square yard appear to decrease seed yield.

6. Increased bee visits shorten the flowering period. Flowers not visited by bees remain open for 8 to 10 days, but where the bee population is one bee per square yard the flowering period is reduced to 3 to 4 days.

7. Honeybees are responsible for about 95 per cent of the pollination of birdsfoot trefoil in the Ithaca area.

129 pages. \$1.61. MicA 55-1260

THE TRISOMICS OF BARLEY

(Publication No. 11,994)

Robert Thomas Ramage, Jr., Ph.D.
University of Minnesota, 1955

Adviser: Charles R. Burnham

Two groups of trisomics were obtained from each of the chromosomal interchanges c1385 (a - b), c1405 (c - d), c1420 (e - f), and c1483 (b - g). Each group and its self progeny may have included six trisomic types based on the constitutions of the extra chromo-

some and the diploid complement of the trisomic plants. These types are (1) primary trisomics, (2) tertiary trisomics, (3) primary trisomic interchange heterozygotes, (4) tertiary trisomic interchange heterozygotes, (5) primary trisomic interchange homozygotes, and (6) tertiary trisomic interchange homozygotes.

Trisomic plants for the a chromosome from c1385 are dwarf, weak, and highly sterile, with no other readily identifiable morphological characteristics. Trisomic plants for the b chromosome from this interchange and from others involving chromosome b, including c1483, are characterized and readily identified by their narrow, dark-green leaves.

Trisomic plants of one group from c1405 (c or d) are normal in appearance and cannot be distinguished from normal diploids. Trisomic plants of the other group (c or d) are characterized by dwarf plants with slender stems, short, narrow leaves, and complete sterility when selfed.

Trisomic plants of one group from c1420 (e or f) are dwarf plants with short, wide leaves; the leaf characters being especially pronounced in the flag-leaf. Trisomic plants of the other group (e - f) are characterized and readily identified by their long, narrow leaves which droop and hang down in an almost vertical position.

The g trisomics from c1483 are weak plants with very few tillers, high sterility, and possess no other readily identifiable morphological characteristics.

The smaller seeds produced on a trisomic plant are more often trisomic than the larger seeds. The smallest third of the seed contained 52.5 percent trisomics as compared with 21.0 percent for the middle third and only 8.0 percent for the largest third.

Trisomic plants derived from outcrossed interchanges were more vigorous and fertile than those obtained from the original interchanges in the variety Mars.

The trisomic plants from each group were crossed with genetic stocks carrying marker genes on both chromosomes involved in the interchange from which they were derived. The numbers obtained in the F_2 were small due to a disease epidemic, but the observed ratios in many cases were obviously not disomic. Several were ratios expected from primary trisomic types. In the tertiary types, by taking into consideration the amount of recombination between the gene and the break-point of the interchange, the location of the gene in relation to the break-point, and whether a dominant or recessive gene is on the interchanged chromosome, the observed ratios fitted expected trisomic inheritance.

A method of obtaining and using trisomics to locate genes without an excessive number of cytological observations is illustrated. With the proper genetic makeup utilizing a marker gene closely linked with the interchange break-point in each chromosome, tertiary trisomics can be set up in which all the progeny with the dominant marker will be of the same marker gene and chromosome constitution as the parental trisomic. Such a tertiary trisomic stock for each of the two interchanged chromosomes could be used to locate any gene in either of the two chromosomes.

94 pages. \$1.18. MicA 55-1261

RESPONSES OF HARD WINTER WHEAT VARIETIES IN REGIONAL TESTS

(Publication No. 11,995)

Louis Powers Reitz, Ph.D.
University of Minnesota, 1955

Major Adviser: E. R. Ausermus

Uniform trials as regional nurseries are used widely in this and other countries. The aim of this study was to determine the extent to which winter wheat varieties were subjected to the hazards of production in the uniform regional tests currently being used in the Plains region, and to determine the nature and some causes of the responses found.

Data from a uniform yield nursery consisting of about 30 varieties grown at 13 stations per year from 1932 to 1953 were used, supplemented by data from other uniform trials. Interstation and interannual correlations of yields of grain were calculated year by year and average yields of varieties by 4-year periods were correlated. The kinds and frequency of the hazards of production were tabulated and related to the responses found. Early ripening was such an important varietal characteristic that a detailed study of it was made.

Twenty hazards of production came into play in the regional trials. The frequency of each hazard was not the same at all locations but practically every one listed at a station was encountered sooner or later at every other station. A short period of years in the region provided a broad cross-section of the hazards to be expected.

The averages of the interstation correlations based on single years were highly significant for the most part but were of a low order. Considering the individual pairs (about 150 per station), Stillwater, Oklahoma, and Manhattan, Kansas, showed the greater percentage of significant r values (38 and 39%); Denton, Texas, Woodward, Oklahoma, Hays, Kansas, Akron, Colorado, Lincoln and North Platte, Nebraska, ranked next as a group (30% or more); and below 20% was noted for Bushland, Texas, Alliance, Nebraska, Fort Collins and Hesperus, Colorado. A geographically radial pattern was evident.

Yields assembled into period averages and then correlated showed higher r values between stations than for the years taken one at a time. In 80% of the cases the 4-year varietal averages showed improved r values, many exceeding .60.

Interannual correlations were calculated for 3 stations. These gave r values no higher, and sometimes lower, than those for the station in the interstation comparisons.

Time of maturity was an important character of adaptation at most of the stations. The greatest contrast between stations was Hesperus, Colorado, where varieties maturing earlier fell off in yield .6 bushel for each day of earliness, whereas at Lincoln, Nebraska, Manhattan, Kansas, and Denton, Texas, each day of earliness increased the yield 1 bushel per acre for the varieties up to a week earlier than Kharkof. Most of the stations tended to follow the latter pattern.

Early maturity was effective in reducing infection and damage by stem rust.

Uniform winterhardness nurseries were found to be only partially satisfactory for the intended use.

It was concluded that regional trials have justifiable use for determining breadth of adaptation and for determining quickly such hard-to-measure characteristics in a variety as yield of grain. Within natural ecological zones a regional average does offset the need for long years of tests at a single station. All stations do not contribute equally nor do all benefit equally from a regional test. Therefore, breeders should make a critical study of the regional results to determine which supplement local data in the best way and have the greatest predictive value. At many stations this would require a subgrouping of the stations in the regional test. Furthermore, some annual adjustments in the subgroupings would be required.

85 pages. \$1.06. MicA 55-1262

A STUDY OF COMBINATIONS OF INSECTICIDES FOR THE CONTROL OF THREE APPLE PESTS IN WESTERN NEW YORK

(Publication No. 11,923)

Donald Edwin Ullrich, Ph.D.
Cornell University, 1955

During recent years there has been increasing interest in the development of combinations of insecticides for the control of apple pests. Combinations of insecticides are generally used in a preventative spray program where the toxicants are applied before the insect populations approach the severely injurious level. This research was devoted to the development of new combinations of insecticides that were superior to the combinations now available. In addition to insect control studies, residue surveys and phytotoxicity observations were recorded.

Insecticides commonly used for the control of apple pests, and new toxicants of relatively uncertain toxicity to the major apple insects were tested. The test insects were codling moth, *Carpocapsa pomonella* (L); red-banded leaf roller, *Argyrotaenia velutinana* (Wlkr.); the European red mite, *Paratetranychus pilosus* (C. and F.); and the two spotted mite, *Tetranychus bimaculatus* (Harvey).

Blocks of McIntosh apple trees in Wayne County, New York were selected for the testing areas during the summers of 1952, 1953, and 1954. Five replicates of each treatment were applied in each experiment. The insecticides were applied with a high pressure spray machine in single tree plots. Observations on the initial appearance and peaks of population were used to time the sprays. Injury counts of codling moth and red-banded leaf roller were made at harvest by examining representative samples of the harvested fruit. All the fallen apples from the data trees were examined for insect injury. Thirty leaves from each of the treated and check trees were removed for counting the mite populations. The mite control was

recorded as the percent reduction over the check or before treatment mite population.

Residue and deposit samples were taken throughout the season in all experiments. Phytotoxic injury of the malathion emulsions in all three years to the McIntosh variety was recorded.

The principal combinations tested were DDT-parathion, DDT-malathion, DDD-parathion, dilan-parathion, and dilan-malathion. Of these combinations the DDT and parathion combination was the best tested. The dilan combinations and the DDD-parathion combinations gave good insect control but were unsatisfactory because of high cost. The DDT-malathion formulation has not been tested sufficiently, but appears to be a possible replacement for the DDT-parathion combination.

Diazinon showed exceptionally good control of codling moth, red-banded leaf roller, and European red mites. This material may be a possible replacement for DDT in the combination sprays. Chlorobenzilate, DDT-malathion, and DDT-parathion combinations gave excellent control of red mites and two-spotted mites in special sprays.

Malathion deposits on the leaves were found to be

considerably reduced by the use of lime in the spray solution with malathion. In the laboratory, tests indicated that malathion was hydrolyzed by lime and the hydrolysis products, the calcium salt of dithiophosphate, was relatively non-toxic to Mexican bean beetle larvae.

The residues of malathion weathered faster in 1953 than in 1952. The deposits of DDT, dilan, and parathion deposited and weathered about the same in all years sampled.

Malathion emulsions were found to cause spotting of McIntosh apples in all three years tested. The severity of the injury varied from year to year, but some injury was always apparent. Tests in 1954 indicated that it was possible to get malathion emulsion injury to McIntosh apples in all four cover sprays applied. The injury in 1954 was most severe on the trees receiving the second and fourth cover sprays. The spotting of the apples becomes more pronounced as the season progresses even though no more cover sprays were applied. There was no apparent increase or new appearance of malathion emulsion injury on treated apples stored for three months in cold storage. 143 pages. \$1.79. MicA 55-1263

BOTANY

TAXONOMIC REVISION OF THE GENUS NUPHAR Sm.

(Publication No. 12,098)

Ernest Oscar Beal, Ph.D.
State University of Iowa, 1955

Chairman: Dr. R. F. Thorne

Yellow Water-lilies occur in a variety of aquatic habitats in Eurasia and North America and locally in northern Africa and the West Indies. The generic name Nuphar Sm. has been adopted for these plants as a nominum conservandum in the International Code of Botanical Nomenclature, the White Water-lilies being retained in the Linnaean genus Nymphaea.

Observations of Nuphar in South Carolina, Georgia, northern Florida, Missouri, southern Illinois and Iowa has been supplemented by the examination of herbarium specimens.

The habit of growth of Nuphar is by means of branching rhizomes, the older portions of which decay. Progressively more numerous growing tips are thus isolated and a colony may be maintained indefinitely without recourse to the normal pattern of sexual reproduction.

This capacity for vegetative reproduction, in conjunction with the isolated nature of aquatic habitats and the ancient status of the Nymphaeaceae (pollen of Nelumbo Adans, and Nymphaea L. has been identified in coal of the Jurassic age) has resulted in the

establishment of innumerable populations of Nuphar which exhibit various combinations of distinctive features. In general, certain combinations of characteristics coincide with the ecological features of various geographic areas.

In some instances there are indications of the presence of intrinsic barriers to interbreeding. The effectiveness of such barriers is quite variable, however. Without doubt, many populations of Nuphar are incapable of interbreeding but the existence of numerous intergrading forms indicates that at least some segments of the involved taxa are not separated by internal barriers.

The recognition of all variants and intermediate forms of Nuphar by systematic taxonomy is not feasible. The identity of the extremes of variation that coincide with geographic or ecological features may, however, be maintained as subspecies.

The Nuphar or Japan is relatively invariable and can be recognized as a distinct species. The genus thus consists of two species; the polymorphic N. luteum (L.) Sibth. & Sm. with nine recognizable subspecies, and the relatively stable N. japonicum DC.

Nuphar luteum consists of the following subspecies: in lower altitudes and latitudes of Eurasia, subsp. luteum; in higher altitudes and latitudes of Eurasia and in northeastern North America, subsp. pumilum (Timm) Beal; in ponds of northern United States and Canada, subsp. variegatum (Engelm. ex Clinton) Beal; in flowing water or tidal mud flats of freshwater streams (rarely in ponds) throughout

eastern United States and extending southward into Mexico and Cuba, subsp. macrophyllum (Small) Beal; in the tidal reaches of streams in Virginia and the Carolinas, subsp. sagittifolium (Walt.) Beal; in acidic ponds of the Coastal Plain in Georgia and northern Florida, subsp. orbiculatum (Small) Beal; in the Blackwater River of western Florida, subsp. ulva-ceum (Miller & Standley) Beal; in the Ozark region of Missouri and adjacent Arkansas, subsp. ozarka-num (Miller & Standley) Beal; and in northwestern North America, subsp. polysepalum (Engelm.) Beal.

European plants intermediate between subsp. luteum and subsp. pumilum and North American plants intermediate between subsp. pumilum and subsp. variegatum are especially numerous and are referred to the categories N. luteum subsp. luteum X N. luteum subsp. pumilum and N. luteum subsp. pumilum X N. luteum subsp. variegatum respectively.

Scarcity of material from southeastern China has prevented a determination of the position of those plants within the genus Nuphar.

Neither chromosome number (in all forms examined $n = 17$) nor pollen morphology appear to be of any taxonomic significance. A comparative study of seedling development in four subspecies of N. luteum (L.) Sibth. & Sm., however, indicates that a more intensive study may prove seedling morphology to be of taxonomic importance in the genus.

Distribution maps, based upon the herbarium specimens examined, indicate the known range of the recognized taxa. 118 pages. \$1.48. MicA 55-1264

COMPARATIVE STUDIES OF PHOTOSYNTHESIS AND THE HILL REACTION IN NOSTOC MUSCORUM AND CHLORELLA PYRENOIDOSA

(Publication No. 12,009)

Thomas Edward Brown, Ph.D.
The Ohio State University, 1954

Adviser: Carroll A. Swanson

The blue-green alga Nostoc muscorum was studied manometrically with respect to its photosynthesis, respiration and Hill reaction capacities in comparison with Chlorella pyrenoidosa. The most generally useful bicarbonate buffers for direct measurements of photosynthesis were found to be 0.025 M Warburg's No. 9 buffer with Na : K ratio 85 : 15 for Nostoc and the same buffer at 0.10 M for Chlorella. The full rate of photosynthesis is not found, however, by this method. The two-vessel or indirect method was used with Chlorella and adapted for use with Nostoc to measure the full rate of photosynthesis. In terms of packed cell volume, the photosynthetic capacity of Nostoc is only 1/2 that of Chlorella; in terms of cell numbers, it exceeds that of Chlorella.

External CO₂ buffering with diethanolamine cannot be recommended, at the present time, for use in photosynthesis measurements.

Photosynthesis was found to be relatively insensitive to extreme centrifuging treatments in both Nostoc and Chlorella, provided mechanical injury did not occur.

Both organisms were found to be quite sensitive to washing treatments. Nostoc being considerably more sensitive than Chlorella. This sensitivity was found to be due to the leaching of potassium from the cells.

The optimum temperature for photosynthesis in Nostoc is ca. 35°C., very similar to that of the Emerson and Burk strains of Chlorella, in which it was found to be ca. 37.5°C. The optimum temperature range for respiration in both organisms is broader but otherwise corresponds to photosynthesis.

The steady rate of photosynthesis in both Nostoc and Chlorella was lower under oxygen than under air. Nostoc showed somewhat greater sensitivity to oxygen than Chlorella. Induction periods were observed in all cases.

A high Hill reaction rate was retained by Nostoc cells whose net photosynthesis, had been abolished by washing. In contrast to photosynthesis the capacity for the quinone reaction in Nostoc and Chlorella remained quite uniform during lengthy storage of the cells at 0°C. The total oxygen yield in the quinone reaction is not controlled by the quantity of cells employed, which indicates that the dark reduction of quinone by algal constituents is of negligible importance. Higher rates of the quinone reaction than of photosynthesis were observed in both organisms over the range 0-15°C. This difference decreased with increasing temperature. Optimum temperature range for the quinone reaction in Nostoc and Chlorella is 15-20°C. Increasing the time of dark exposure of the cells to quinone at 10 and 25°C. reduces the subsequent rate of oxygen production at 10°C. Apparently quinone kills the cells and so renders the photochemical reaction as thermolabile as isolated chloroplasts.

When the normal concentration of potassium is restored to potassium-deficient cells, there is no response for 20 minutes. Thereafter there is a steady increase in the rate of photosynthesis. Recovery appears to require as much time as recovery of normal growth rate. 120 pages. \$1.50. MicA 55-1265

A SYSTEM FOR THE CLASSIFICATION OF CORN INBRED LINES

(Publication No. 12,011)

Daniel Robert Butler, Ph.D.
The Ohio State University, 1954

Adviser: Glen H. Stringfield

This investigation is the result of observations made on sixty-six corn belt inbred lines of corn with respect to thirty-eight taxonomic characters. A classification key and a description of each inbred line are included in this study.

All inbred lines were grown in 1949 and 1951 at

Columbus, Ohio. The inbred lines were grown on Genesee silt loam and Miami silt loam each year. In 1948, thirty of the inbred lines were grown at Wooster, Ohio, on Wooster silt loam. Records were kept for all thirty-eight characters at the two locations in 1949.

The taxonomic characters consist of: ratios of plant-part measurements, tassel characters, ear and kernel characters, measurements of maturity and disease resistance. In the construction of the classification key, fifteen of the thirty-eight characters were used. These are as follows:

1. Cob color
2. Anther color
3. Silk Color
4. The presence or absence of a sun red lateral band at the base of the glumes in the tassel.
5. The straightness of the tassel branches as distinguished from dropping or bowed branches.
6. Ratios of plant-part measurements
 - a. Plant height to stalk circumference.
 - b. Plant height to height of top ear-bearing node.
 - c. Plant height to length of top ear-leaf blade.
 - d. Plant height to tassel length.
 - e. Length of top ear-leaf blade to its width.
 - f. Tassel length to spike length.
7. Number of primary tassel branches.
8. Peduncle length (measured from the base of the lowest tassel branch to the top of flag leaf sheath).
9. Number of kernel rows.
10. Number of leaves above top ear-bearing node.

In undertaking the construction of the classification key, it appeared necessary to calculate the variance of as many of the above listed characters as possible. The variance and constancy of a character will largely determine its value for classification purposes. However, characters 1 through 5, do not lend themselves to statistical analysis and are described in context only.

The first character, cob color, appeared to be unaffected by environment, on the basis of a red and white distinction. Characters 2 through 4, appeared to be affected relatively little by environment. All of the first five characters were fairly uniform within inbred lines. These characters were used as major divisions in the classification key.

Characters 6 through 10, were statistically analyzed. The primary object of the statistical analysis was to evaluate the effect of location. The chi-square test of independence was performed for each of these characters. All of these characters, with the exception of 6a. and 6f., were shown to be affected significantly by location, and are, therefore, of questionable value for classification.

In addition to the chi-square test of independence, the net variance, independent of location and inbred lines, was calculated for characters 6 through 10. The standard deviations and coefficients of variation were calculated from these net variances. The

coefficients of variation were 5.2 per cent or less with the exception of those for the number of primary tassel branches and the peduncle length, which had values of 11.8 per cent and 30.2 per cent respectively.

Of the remaining twenty-three characters, none was statistically analyzed. However, there was no evidence that any of these characters is free of environmental influence.

The study of ratios as used in this investigation is essentially a study of the form of plants: that is, the size of one plant part relative to that of another plant part, as distinguished from plant-part size per se. At the outset of the problem, it was hypothesized that plant form is not subject to environmental influence or that the environmental influence would be small as compared with the hereditary effect. In either case plant form could be used as a basis for classifying inbred lines of corn. The evidence of this investigation indicates that some of the aspects of plant form, as well as plant-part size per se, are influenced by environment.

Another complicating factor in the classification of inbred lines of corn, in addition to the environmental influence, is the quantitative nature of virtually all characters studied in this investigation. With the exception of cob color, on the basis of a red and white distinction, all characters were found to be of the quantitative type. Such characters make a sharp division between any two classes impossible. The resulting classification key is automatically longer because of a duplication of inbred lines whose values are intermediate between two classes.

92 pages. \$1.15. MicA 55-1266

A STUDY OF AN ORCHID ROOT-ROT FUNGUS

(Publication No. 12,025)

Virginia Foster, Ph.D.
The Ohio State University, 1954

Adviser: William D. Gray

Two *Cattleya* Lindl. orchid plants which the author was cultivating as a hobby wilted, their leaves abscised, the roots decayed, then the pseudo-bulbs and rhizomes died. They had been healthy until changed from potting material of sphagnum moss to *Osmunda* fibers.

Microscopic Examination of the diseased orchid plants revealed the presence of septate hyphae in and among the host plant cells. A pink *Fusarium* grew from surface-sterilized pieces of the orchid tissue placed on sterile agar in petri plates. This same *Fusarium* also grew from surface-sterilized pieces of the *Osmunda* fibers taken from the stock used in the repotting.

This fungus is morphologically most like *Fusarium orthoceras* App. et Wr. var. *longius* (Sherb.) Wr. in the *Elegans* section of the *Fusaria*.

Other *Cattleya* plants were inoculated by pouring spore suspensions of this *Fusarium* over the roots,

then pricking the roots with sterile needles. The same symptoms developed in these plants. The same *Fusarium* was recovered from the rotted roots of these plants.

Fourteen single spores were obtained with a micromanipulator and allowed to grow in pure culture. Three of these isolates were used in a root inoculation experiment in which *Cattleya* plants inoculated with one of each of these isolates were placed with a check plant in three different environments for a 48-hour incubation period. The three plants inoculated with one of the isolates were definitely stunted. The flowers on the inoculated plants were fewer, smaller, and shorter-lived than the flowers on the check plants. There was no apparent difference in the results obtained from the use of the three different incubation environments. The isolates used in this experiment were less pathogenic than the cultures used in previous tests.

A study was made of the effect of solution culture filtrates, in which the various single spore isolates had been growing for different lengths of time, on the respiration of pieces of *Cattleya* leaf tissue. There was more absorption of oxygen by leaf tissue immersed in some of the solution culture filtrates than in others. There was also increased oxygen absorption by orchid leaf tissue at certain age periods of the culture solutions, and decreased oxygen absorption at other age periods of culture filtrates of the same isolates.

There was an increase in alkalinity of the culture solutions up to a point between one hundred and one hundred fifty days of growth of the fungus isolates. Then a slight decline in alkalinity occurred.

Permeability effects of culture filtrates on orchid petal tissue could not be measured by means of diffusion of anthocyanins because a decolorization of the pigments took place.

Excised Bonny Best var. tomato plants were placed in solution culture filtrates in which the isolates had been growing for different lengths of time. A tomato-wilting toxin appeared in cultures of some of the isolates within ten days, but in cultures of some other isolates this toxin did not appear till the fiftieth day of fungus growth.

This tomato-wilting toxin is alcohol-soluble and thermostable. Another factor in the filtrates which causes the edges of the tomato leaflets to curl up and dark spots to appear on the leaflet blades is insoluble in alcohol and thermostable.

87 pages. \$1.09. MicA 55-1267

A STUDY OF HELMINTHOSPORIUM SATIVUM P. K. & B. AS AN UNREPORTED PARASITE OF AGROSTIS PALUSTRIS HUDS.

(Publication No. 12,143)

William Klomparens, Ph.D.
Michigan State University, 1953

Symptoms are described for an extremely destructive disease of creeping bent grass, *Agrostis palustris* Huds. Large areas of turf may turn smoky blue, then chlorotic, followed by the complete destruction of the affected grass plants. *Helminthosporium sativum* P. K. & B. is the fungus constantly associated with the disease symptoms. Fifty-eight isolations and identifications are listed, with sources ranging from Texas to Ohio. *H. sativum*, isolated from creeping bent grass, and an isolate from J. J. Christensen, of Minnesota, both were found to cause complete death of established creeping bent grass. These same isolates were compared for pathogenicity to bent grass seedlings and to wheat; the damage caused by all isolates was the same on any one host.

Four attempts to produce the perithecial stage were unsuccessful, using twelve media, ultraviolet light, and varying environmental conditions. The variability of bent grass isolates of *H. sativum* grown on artificial media corresponded with the variability of this species as reported in the literature. *H. sativum* isolates from creeping bent grass were found to be stimulated when grown in medium containing small amounts of mercuric and mercurous chloride (10 and 50 ug/ml), while the known isolate from Minnesota was not stimulated. Nematodes were tested alone and in combination with fungi for pathogenic effects. No effect was found under the conditions of the tests. Dr. G. Thorne, Nematologist, however, felt that *Tylenchorhynchus* sp. was parasitizing a sample of creeping bent grass sent to him for identification and observation. *Curvularia* sp. was found to be mildly parasitic to creeping bent grass. *Pleosphaerulina* sp. was described and shown to be parasitic on creeping bent grass.

83 pages. \$1.04. MicA 55-1268

STUDIES ON THE DISTRIBUTION OF PHOSPHORUS-32 IN PISUM SATIVUM, IN RELATION TO FRUIT DEVELOPMENT

(Publication No. 12,177)

Albert John Linck, Ph.D.
The Ohio State University, 1955

This study was initiated as a result of observations that commercial varieties of *Pisum sativum* do not yield as large a crop of peas as is possible. Observations on the Alaska variety, used throughout this study, indicate that less than 50 per cent of the ovules which begin development in the ovaries never reach full maturation (canning size).

Microscopic examination of ovularies harvested 4 and 7 days after anthesis revealed that an embryo was developing in almost every ovule. Thus, lack of fertilization did not appear to be an important cause of the incomplete development of the ovules. Differences in the size of the ovules and the embryos was first apparent in the ovularies harvested 7 days after anthesis. The cause of this aberrant development in the early stages of embryogenesis is not known.

It has been reported that phosphorus-32 (P^{32}) applied to the leaves can be used as an indicator of the movement of organic materials in the phloem. This technique was employed here in studying the distribution patterns of phloem-transported materials and some factors affecting the accumulation of these metabolites by the pods.

The results of these studies on the distribution of phosphorus-32 in the Alaska variety of *Pisum sativum* can be summarized as follows:

1. The distribution patterns for movement of organic materials in the phloem from the leaves were found to be highly specific. P^{32} -labeled materials moving from the first bloom node leaf accumulated predominantly (usually 70-80 per cent of the total P^{32} -activity in the plant) in the pod at that node.
2. Distribution from a lower leaf node (i.e., 5th or 7th) was predominantly downward, with little or no accumulation in the pods. In these mature plants a relatively small fraction of the translocation stream from the 5th node accumulated in the roots. This varied somewhat, apparently with the size and vigor of the root system.
3. There was no significant accumulation of phosphorus-32 by the flower before anthesis. At 4 or 6 days following anthesis a considerable amount of P^{32} was translocated to the carpel, to the sepals, and to the ovules. At this stage there was a large accumulation of labeled materials in the stem above and below the node of entry — whereas before anthesis these plant parts accumulated only small amounts of P^{32} .
4. Removal of the first pod or of the mature seeds from this pod resulted in a shift in the translocation stream to the second pod and to the stem above and below the leaf to which the P^{32} was applied. Reorganization of the transport pathway when the first pod was removed occurred rapidly, thus suggesting the dynamic nature of the phloem transport system.
5. Studies on the movement of phosphorus-32 from a leaf during periods up to 27 hours indicate that a near steady-state was reached at the end of 8 hours, at which time the first pod contains about 90 per cent of the total P^{32} -activity. There was only a slight subsequent increase in the P^{32} -content of the second pod, and losses by the stem tissue were small. Thus no net efflux from the first pod occurred during the light or dark period following application.
6. When the metabolic activity of the first pod was lowered by cooling, the movement of P^{32} to this pod, as well as to all other parts of the plant, was restricted when no other pods were present. When another (uncooled) pod was present, P^{32} movement was shifted to the second pod, and the effect of cooling the first pod on the distribution pattern was less striking.

When the first pod was given a "high" temperature treatment (34-30°C.), there was no reduction in the accumulation of P^{32} by this pod. There was some evidence of a slight increase for the 3-4 hour duration of the treatment.

122 pages. \$1.53. MicA 55-1269

STUDIES ON THE GERMINATION OF VANILLA PLANIFOLIA

(Publication No. 9762)

Herminio Lugo Lugo, Ph.D.
Cornell University, 1954

Vanilla is an indigenous plant of Mexico and Central America. Production of hybrids of good flavoring properties and resistant to the diseases which are destroying the *Vanilla* plantations is an economic necessity. It had been impossible for botanists to produce *Vanilla* hybrids until recently because of the lack of an appropriate technique by which the seeds of this orchid could be germinated. After the experiments of Bouriquet and Boiteau in 1937, and the success obtained by Knudson in producing the first hybrid seedlings of *Vanilla* in 1939, the desirability of further investigation of *Vanilla* seed dormancy became apparent and the study reported here was undertaken.

Seeds of *Vanilla planifolia* (Andrews) were used in all the experiments. The seeds were sterilized for about 20 minutes in filtered calcium hypochlorite solution and transferred aseptically from the sterilizing solution to agar plants with an inoculation needle. Knudson's Solution B was employed as the culture medium for most of the experiments performed. The different constituents of this solution were varied in several ways in an effort to obtain the optimum nutritional conditions for maximum germination.

The number of germinated seeds was increased when the concentration of Solution B was reduced by dilution with distilled water. The highest germination was obtained when the concentration of the medium was lowered to one-tenth its normal concentration. In determining which constituent of Solution B was inhibiting germination at the higher concentrations, the nitrogen concentration of the culture medium was found to be the critical factor in the germination of *Vanilla* seeds. The greatest number of seeds germinated when the nitrogen concentration of Solution B was very close to zero. Germination was very poor when the normal nitrogen concentration of Solution B was used and it was completely inhibited when higher concentrations of inorganic nitrogen were employed.

When the separate effects of different concentrations of nitrate and ammonium ions on germination were compared, it was found that nitrogen in the form of nitrate caused a higher inhibition on germination than ammonium. However, even less inhibition of germination was obtained with organic nitrogen in the form of urea. The use of recrystallized salts, and the addition of several other organic nitrogen sources to Solution B media failed to produce any

stimulatory effect on the germination of *Vanilla* seeds.

Sugar, normal atmospheric oxygen pressures, a temperature of 32°C., and darkness are essential for *Vanilla* seed germination. The hydrogen ion concentration of the medium does not appear to be a critical factor in the germination of these seeds. Water extracts of embryos and whole ungerminated seeds were tested for the presence of germination inhibitors with negative results. Similar 95 per cent ethanol extracts and treatment of seeds with alcohol before planting inhibited the germination of *Vanilla* seeds.

Treatment of seeds with three per cent hydrogen peroxide solutions for 24 hours before planting increased the germination percentage of *Vanilla* seeds. Higher germination increases were obtained when the hydrogen peroxide treated seeds were planted on Solution B medium with one-thousandth normal nitrogen concentration.

Pretreatment of seeds with different concentrations of thiourea and the addition of vitamins and indoleacetic acid to the medium produced no striking differences in the germination of *Vanilla* seeds. Ethyl vanillate, and to some extent vanillin, inhibited the germination of *Vanilla*. Complete inhibition of germination was produced when *Vanilla* seeds were exposed to different concentrations of ether, chloroform, or ethylene chlorohydrin vapors for varying lengths of time.

Revisions in the formulation of Knudson's Solution B to provide for maximum germination of *Vanilla* seeds are suggested.

130 pages. \$1.63. MicA 55-1270

STUDIES ON THE CREEPING-ROOTED CHARACTER IN ALFALFA

(Publication No. 11,912)

Beatrice Estella Murray, Ph.D.
Cornell University, 1955

Creeping-rooted alfalfa shows considerable promise for use as a pasture legume in the dry plains region of Canada. Three studies associated with the use of the character in plant breeding were investigated, with the objective of obtaining information which would contribute to our understanding of the creeping-rooted habit in alfalfa.

The first of these studies concerned the determination of the origin of adventitious stems on roots. The second involved observations on the influence of environment on the expression of this habit of growth. The third was an attempt to find a laboratory technique to identify, on a mass scale, individual plants which express this method of vegetative propagation.

An ontogenetic study of adventitious stem formation on root segments of creeping-rooted clones revealed that meristematic activity is evident first in the phellogen near a lateral rootlet. Continued mitotic activity in that region gives rise to a primordial dome from which adventitious stems eventually

emerge. Meanwhile dedifferentiation and subsequent redifferentiation occurs in the subjacent phloem parenchyma within which vascular tissues differentiate connecting the peripheral domes with the cambium of the root and, in some instances, the cambium of the lateral rootlet. Factors such as age of root; stage of development of the above ground portion of the plant; indeterminate growth habit and artificial culture treatment, in addition to inherent differences, influence adventitious stem initiation and development on roots of creeping-rooted alfalfa.

A field study on spaced planted creeping-rooted clonal lines indicated that differences in creeping-rootedness are manifested by density of adventitious stems, the time and rate at which these stems appeared, extent and rate of vegetative spreading, length of root per unit area and potential creeping-rootedness. The creeping-rooted habit appears to be influenced markedly by the environment of the individual plant, since variation in density also was observed to occur within clonal lines.

Under culture treatment some creeping-rooted as well as non-creeping-rooted selections responded oppositely to their performance under field conditions of growth regarding the development of stems on roots. It was found that supporting root segments in trays of running water was a satisfactory method for inducing adventitious stems. However, as a technique to predict reliably creeping-rootedness or distinguish between creeping and non-creeping-rooted plants, it did not appear to be suitable.

117 pages. \$1.46. MicA 55-1271

THE BIOSYNTHESIS AND ROLE OF HORMONES IN THE FRUIT DEVELOPMENT OF TOBACCO

(Publication No. 12,117)

Leslie Godell Paleg, Ph.D.
State University of Iowa, 1955

Chairman: Dr. R. M. Muir

Experiments were performed in an attempt to determine the biosynthetic pathway to indoleacetic acid and other hormones produced during fruit development of tobacco. Studies of the roles of these compounds during the development of the fruit and the effects of developing fruits upon one another were also made.

The free acid and neutral hormone fractions of unpollinated, pollinated and fertilized Little Turkish tobacco ovaries were extracted and assayed by straight growth induced in *Avena* coleoptile sections. The hormone content of unpollinated ovaries was too low to measure. However, pollination and tube growth promote an immediate rise in the neutral hormone level of ovary tissues which then falls off sharply between the third and fourth day after pollination, at about the time that fertilization is completed. At this same time the content of acid hormone is greatly increased. It is suggested that neutral hormone

production is initiated by pollen germination and tube growth, and that the formation of acid hormone is stimulated by fertilization and accompanying processes.

The hormone content of pollen germinated by five hours incubation in glucose and boric acid medium is less than that of ungerminated pollen and it is shown that even the latter does not contain enough hormone to account for the increase in hormone levels of pollinated and fertilized ovary tissue. Total tryptophan levels in germinated and ungerminated pollen are the same.

Free tryptophan comprises most of the tryptophan present in unpollinated ovaries. As the ovary remains attached to the plant but unpollinated, tryptophan is accumulated in the free state. When pollinated, however, there is a relatively small increase in free tryptophan and a large immediate increase in the amount of bound tryptophan. That this increase of bound tryptophan occurs as early as eight hours after pollination and is a product of *in situ* synthesis rather than translocation and accumulation is shown by the results of experiments involving incubation of pollen extract and ovary tissue. Almost twice as much tryptophan was extracted from the mixture of pollen and ovary tissue as was extracted from the components when incubated separately.

Tryptophan levels in the pollinated ovaries are 50 to 100 times as great as the hormone levels and therefore any quantitative relationships between the two components, if such exist, could not be demonstrated. No additional amounts of hormone could be extracted from either pollinated or unpollinated ovaries by incubating these tissues with tryptophan. Also, it was not possible to demonstrate the formation of hormone by the incubation of Little Turkish pollen and ovary tissue. All of the hormone extracts of the mixtures of pollen and ovary incubated at pH levels from 6 to 8 produced significantly less elongation than did the extracts of ovary or pollen when incubated alone.

The direct relationship between the number of seeds produced within a fruit and the size the fruit attains at maturity is demonstrated for the many-seeded fruits of Little Turkish and Lizard's Tail varieties of tobacco.

In plants of the Lizard's Tail variety the presence of many or few fruits has no effect on the abscission of seedless ovaries, the number of seeds set in fertilized flowers, or the weight of the seeds produced. The absence of subsidiary fruits on Little Turkish plants, however, causes the retention of seedless ovaries. The results suggest that this effect is due to the lack of formation of a precise abscission mechanism (as compared with Lizard's Tail variety) and the subsequent passage of nutrients through the abscission zone. Also, a greater number of seeds are

produced, each seed attaining greater weight than those on plants with subsidiary fruits.

88 pages. \$1.10. MicA 55-1272

BIOLOGY, CYTOLOGY AND TAXONOMY
OF *COCHLIOBOLUS SATIVUS* WITH
NOTES ON THE *COCHLIOBOLUS*
STATES OF *HELMINTHOSPORIUM* SPECIES

(Publication No. 12,282)

Robert Alan Shoemaker, Ph.D.
Cornell University, 1955

Cochliobolus sativus (Ito & Kurib. ex Kurib.) Drechs. ex Dast, produced mature ascocarps on seeds of *Zea mays* L., previously disinfested with mercuric chloride, boiled one minute to kill the embryo and partly immersed in Sach's agar. Isolates of the conidial state, *Helminthosporium sorokinianum* Sacc. ex Sorokin (= *H. sativum* Pamm., King & Bakke), and monoascosporic isolates were hermaphroditic and heterothallic. Uninucleate, spherical spermatia 1.7 μ wide, the sole male agents in plasmogamy, were produced in phialids in slime-filled spermogonia measuring 2.5 x 2.5 mm. Hyphal fusions and conidiation did not initiate the heterokaryon in the ascogonium. Homokaryotic isolates and incompatible crosses produced partially mature ascocarps by differentiation of maternal stroma. Pseudoparaphyses extended downwards from sub-apical stromatic cells and produced locules. Subsequently in compatible crosses the heterokaryotic ascogenous hyphae grew from the sub-basal pseudoparenchyma and produced a fascicle of asci in the locule. Eight scolecospores, uninucleate at inception, formed after meiosis. The gametic chromosome number is 6. The asci had two walls (bitunicate) but the inner wall was not evident in asci filled with spores nor functional in spore discharge. Whole asci extruded from the ascocarp in slime and dehisced in water by a terminal circumscissile reapture. *Cochliobolus* Drechs. was placed in the Pseudosphaeriaceae Höhn. sensu Luttrell in the Pseudosphaeriales Thiessen & Sydow.

Under like conditions *Helminthosporium victoriae* Meehan & Murphy produced spermogonia distinguished from those of *C. sativus* only by the dimensions of external conidiophores and conidia. Incipient ascocarps 600 x 725 μ with beaks 300 x 275 μ formed with *H. victoriae* conidia on the exterior. Interspecific crosses attempted with spermatia of *H. victoriae* applied to ascogonia of isolates of both mating types of *C. sativus* did not result in the formation of ascogenous hyphae or asci, which may be cited as evidence of the genetic isolation of the two species.

63 pages. \$1.00. MicA 55-1273

CHEMISTRY

CHEMISTRY, GENERAL

ANALYTICAL APPLICATION OF THE REACTION BETWEEN SULFUR AND AN ALKALI CYANIDE

(Publication No. 12,256)

James Kenneth Bartlett, Ph.D.
Stanford University, 1955

The reaction between sulfur and an alkali cyanide has been utilized in the development of three new methods of analysis, (1) colorimetric estimation of small quantities of elemental sulfur, (2) volumetric determination of larger quantities of sulfur, and (3) volumetric determination of cyanide ion.

Colorimetric Determination of Sulfur. Sulfur is quantitatively converted to thiocyanate in 95 per cent acetone medium. Addition of a solution of ferric chloride produces a colored complex which exhibits maximum absorbance at 465 millimicrons. The absorbance of this complex bears a linear relationship to sulfur concentration. The proposed method is applicable for determinations in the concentration range of two to fifty parts per million. Samples containing over 10 per cent water yield low results for sulfur. Mercaptans and hydrogen sulfide interfere and must be removed by treatment with aqueous mercuric chloride prior to analysis. Although particularly suitable for the determination of sulfur in hydrocarbons, the method should be applicable for analysis of many other samples.

Volumetric Determination of Sulfur. Acetone is commonly employed for extraction of sulfur from various materials. A volumetric procedure has been developed in which the extracted sulfur is titrated directly with a standard solution of sodium cyanide in 80 per cent isopropyl alcohol. An acid-base indicator or potentiometric method is employed for detection of the equivalence point. Quantities of sulfur between ten and seventy-five milligrams may be titrated with 0.05 molar cyanide reagent. Standardization of the cyanide solution is carried out by sulfur titration or by a modified Liebig procedure. Mercaptans and alkali hydroxides interfere with the analysis.

Volumetric Determination of Cyanide Ion. Sulfur and cyanide ion react very rapidly in solutions containing high concentrations of pyridine. A volumetric method for cyanide determination has been proposed in which the equivalence point of this reaction is indicated by the appearance of a turbidity of undissolved sulfur. A standard solution of sulfur in pyridine is employed for the titration. The reaction medium is a mixture containing two volumes of water to one volume of pyridine. Results for cyanide as determined by titration with sulfur are generally not as precise as those obtainable with the Liebig method; however, the sulfur procedure may be employed in the

presence of high concentrations of chloride, bromide, iodide, and thiocyanate.

121 pages. \$1.51. MicA 55-1274

A STUDY OF ELECTROLYTIC METHODS FOR THE SEPARATION OF PLATINUM, PALLADIUM, RHODIUM, AND IRIIDIUM

(Publication No. 12,010)

Joseph Bubernak, Ph.D.
The Ohio State University, 1954

Adviser: William MacNevin

The object of this research was to develop electrochemical methods for improving the analytical scheme for the platinum metals. The elements considered excluded osmium and ruthenium since their separation and determination are relatively easy by the Gilchrist-Wichers procedure.

The methods of investigation included the taking of rest-potential and current-potential measurements as well as the carrying out of electrolyses. The rest-potential measurements showed that the order of ease of reduction of these platinum-metals is:



It was also shown from these data that the voltage intervals between these rest-potentials were greater when the solutions contained a high concentration of chloride ion. This indicated a greater possibility of electrolytic separations when excess chloride is present than in pure metal chloride solution.

Current-voltage data were obtained by the use of using a Fisher Electropode and a platinum micro-electrode. An electrolyte which contained 1.0 M hydrochloric acid and 3.0 M sodium chloride was found to be suitable for the separation of palladium, rhodium and iridium. The potential ranges for reduction processes involving platinum overlap those of the other processes, thereby excluding possibilities for separations of platinum from the other metals. Current-voltage studies were also made on solutions of the platinum-metals in sulfate, perchlorate, phosphate, oxalate and other supporting electrolytes. These electrolytes also proved unsuitable for the separations of platinum from the other metals, either because the potential ranges for the various processes overlapped or because of the phenomenon of co-deposition.

Several electrolyses made in a two-compartment cell in which the anode and cathode were separated by a porous clay diaphragm showed that the separation of palladium from rhodium was not complete when the hydrochloric acid-sodium chloride electrolyte was

used. However, the separation was much better when a one-compartment cell was used with hydrazine dihydrochloride as anodic depolarizer. Moreover, it was found that the separation of these two metals from iridium was found to be possible with the use of this electrolyte.

An analytical scheme was devised in which the Gilchrist-Wichers method was modified to include electrolytic methods. After separation of osmium and ruthenium by distillation, platinum is separated from palladium, rhodium, and iridium by precipitation of the latter metals as their hydrated dioxides. Platinum may then be determined in the filtrate by electrolytic deposition. The precipitate of hydrated dioxides is dissolved in hydrochloric acid and the solution made to contain 0.5 M hydrochloric acid and 3.0 M sodium chloride with 8.0 grams hydrazine dihydrochloride added per 175 milliliters of solution. Palladium is deposited from this solution at a cathode potential of +0.050 volts vs. the saturated calomel electrode and temperature of 60° C. Rhodium is next deposited at -0.250 to -0.275 volts and 60° C. Iridium may then be precipitated from the solution as the hydrated dioxide and ignited to the metal in hydrogen. One such analysis gave the following results:

taken, mg.:	Pt 21.88	found, mg.:	21.35
	Pd 22.08		21.87
	Rh 19.60		19.63
	Ir 26.48		26.83

Separations have been carried out satisfactorily for mixtures of palladium, rhodium and iridium in which the relative concentrations of these metals were varied within wide limits. Several results are listed in Table I. The results for palladium are seen to be

TABLE I

Electrolyses in 0.5 M HCl and 3.0 M NaCl
with 8.0 Grams Hydrazine Dihydrochloride
Added per 175 Ml.

Run No.	Palladium		Rhodium		Iridium	
	taken, mg.	found, mg.	taken, mg.	found, mg.	taken, mg.	found, mg.
3-15	44.47	44.22	7.70	8.15	53.34	53.60
3-16	8.68	8.61	39.44	39.16	26.48	26.91
3-17	89.04	88.97	7.71	7.91	10.41	10.51
3-17-B	8.69	8.69	78.93	78.75	106.73	-

satisfactory. Good results are obtained for rhodium except that the relative error is somewhat high when small amounts are determined. Iridium tends to give high results using this method.

114 pages. \$1.43. MicA 55-1275

COMPOSITION AND PROPERTIES OF SOLID PRODUCTS OBTAINED BY THE PASSAGE OF HIGH TENSION SPARKS THROUGH MIXTURES OF METHANE AND WATER VAPOR OR MIXTURES OF METHANE, AMMONIA, AND WATER VAPOR

(Publication No. 12,013)

Winifred Cole Carr, Ph.D.
The Ohio State University, 1954

A yellowish-brown substance is produced when mixtures of methane and water vapor are subjected to high tension spark discharge. It absorbs oxygen when exposed to air and the resulting solid is almost chemically inert. The substance obtained from the sparking is probably polymerized acetylene, or cuprene, which absorbs oxygen upon exposure to air. Hydrogen peroxide reacts with it to form a product that is soluble in certain organic solvents. This product apparently undergoes a partial loss of water when heated in melted camphor and forms two products, one of which is soluble in camphor. This camphor-soluble derivative was assigned the molecular formula, $C_{54}H_{70}O_{16}$, on the basis of elementary analyses and molecular weight determinations. Solutions of this product in acetone or camphor are deep red in color. Although its structure is not known, its infrared spectrum indicates that the oxygen is present in carbonyl groups.

The sparking of a mixture of moist methane and ammonia results in the formation of a reddish-brown to black solid, in addition to large proportions of hydrogen cyanide and ammonium cyanide. This solid dissolves in acids and bases, and to a limited extent in certain organic solvents, such as pyridine, to give dark red or reddish-brown solutions. Elementary analysis indicated a carbon to nitrogen ratio of 3 to 2. No degradation products were obtained in attempts to hydrolyze the product in both acidic and basic media, or from experiments based on the reduction of the original product. However, oxidation with hydrogen peroxide or potassium permanganate gave a product which formed a yellow precipitate with silver nitrate or mercuric chloride solutions. Attempts to isolate the compounds responsible for these precipitates from the metallic salts were unsuccessful. When the gum produced by the reaction between hydrogen peroxide and the original substance is rubbed with methanol, a yellow amorphous solid is obtained. This yellow solid is soluble in water, somewhat soluble in methanol, and insoluble in acetone and ether. It is acidic, forms an insoluble silver salt, and couples with diazotized sulfanilic acid to form a yellow to red solution. The behavior of some of these products suggests the presence of imidazoles.

In general, the solids formed by the passage of high tension sparks through mixtures of certain simple gases were found to be highly complex organic compounds or mixtures of such compounds.

52 pages. \$1.00. MicA 55-1276

SULFATION OF CHITOSAN

(Publication No. 12,031)

Tsung-men Shen Han, Ph.D.
The Ohio State University, 1954

The search for synthetic anticoagulants has heretofore led to no practical substitute for heparin. Although compounds with some anticoagulant activity have been obtained, they are also relatively toxic.

Extensive work by numerous investigators indicated that the activity of heparin is dependent, among other things, upon the sulfamic acid linkage present in the molecule. Theoretically, the sulfation of mucopolysaccharides should yield compounds approaching in some degree the structure of heparin. In order to test the validity of this postulation, chitosan, a D-glucosamine polymer, was used in the sulfation experiments. This permitted the introduction of both the sulfamate and the sulfate acid ester groupings into a carbohydrate skeleton for the purpose of producing a heparin-like anticoagulant.

Several methods of sulfation were tried, including treatment with mixture of sulfur dioxide and sulfur trioxide, chlorosulfonic acid in pyridine and the use of pre-formed sulfur trioxide-N,N-dimethylformamide complex in an excess of N,N-dimethylformamide. Owing to the insoluble nature of the chitosan in most of the organic solvents, the surface of the suspended solid must be activated by swelling in the solvent to form a colloidal suspension. Otherwise, poor results were obtained from the sulfation experiments.

The sulfated chitosan, isolated from the sulfur dioxide and sulfur trioxide mixture in dry, ethanol-free chloroform solvent, was found to have a sulfur content of 15.4 per cent, corresponding to about 3.5 sulfate groups per anhydrodisaccharide unit. Its anticoagulant activity was 12 I.U./mg., which was much lower than the sulfated chitosan prepared from the chlorosulfonic acid and dry pyridine, i.e., 56 I.U./mg. The latter preparation, containing essentially two O-sulfate and two N-sulfate groups per anhydrodisaccharide unit, exhibited the behavior in the Van Slyke amino assay characteristic of the acid-labile N-sulfate group present in heparin. Therefore, it is probable that both contained the same type of N-sulfate linkage. The anticoagulant activity observed here was much higher than any other previously obtained by sulfating any polysaccharide. This was evidence to support the findings of Wolfrom and his associates regarding the contribution of sulfamic acid linkages to the anticoagulant activity of polysaccharide polysulfuric acid esters of the heparin type. However, this preparation was found to be twice as toxic as heparin.

The molecular weight of the sulfated chitosan, prepared from the chlorosulfonic acid and pyridine method, was determined in a 0.2 M sodium chloride solution by the light scattering technique. It had an observed molecular weight of 456,000, i.e., a weight average D.P. of 638 anhydrodisaccharide units. This was considered to be the main factor which caused the toxicity of the sulfated chitosan.

A homogeneous sulfation process for chitosan was established by using sulfur trioxide-N,N-dimethylformamide complex in an excess of N,N-dimethylformamide as the sulfating agent. The sulfated chitosan thus obtained was found to have an anticoagulant activity of 50 I.U./mg. Its molecular weight was 186,000 or a weight average D.P. of 263 anhydrodisaccharide units, with a marked decrease in toxicity. Its L.D.₅₀ (mouse, I.V.) = 775 mg./kg. was about equal to that of heparin (750 mg./kg.). This result confirmed the assumption that toxicity was conditioned by the molecular weight of polysaccharide polysulfuric acid esters.

Another objective of this work was to study the relative stability of the N-sulfate and O-sulfate linkages toward mild acid hydrolysis. The model compound used here was the barium salt of the fully sulfated methyl glycoside of D-glucosamine hydrochloride which was prepared by sulfating the methyl 2-amino-2-deoxy-β-D-glucopyranoside hydrochloride with chlorosulfonic acid and pyridine at 60°. It was found that a 3×10^{-4} M solution of this substance in 0.04 N hydrochloric acid, at 95°, lost 1 mole of sulfate in ≤ 20 min. with the concomitant release of the free amino group. The O-sulfate was removed slowly and the only completely so, after 12 hr.

84 pages. \$1.05. MicA 55-1277

A GRAVIMETRIC METHOD FOR THE ANALYSIS OF ORGANO-GERMANIUM COMPOUNDS USING PHENYLFLUORONE

(Publication No. 11,985)

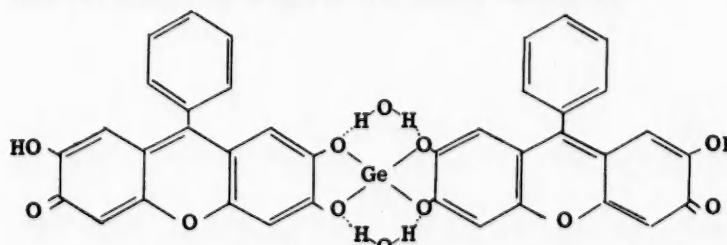
Horatio Henry Krause, Jr., Ph.D.
University of Minnesota, 1955

Major Adviser: Otto H. Johnson

Procedures were developed for the oxidation of organo-germanium compounds by the use of 30% hydrogen peroxide in a sealed glass tube and by the use of a Parr peroxide bomb.

The hydrolysis and the stability of phenylfluorone solutions were studied, and conditions were determined under which it would be suitable for use as a gravimetric reagent for germanium.

The structure of the germanium-phenylfluorone chelate was elucidated by interpretation of the analyses for carbon, hydrogen, germanium, and water, as well as by the infra-red spectra and pyrolysis data. The results indicate a structure which gives a gravimetric factor of 0.09743 for the germanium:



A gravimetric technique was developed in which germanium is precipitated by phenylfluorone in a

medium which contains 75% by volume of ethanol and is 1M with respect to HCl.

Comparison of results on organo-germanium compounds obtained by both methods of oxidation followed by precipitation with phenylfluorone are given.

59 pages. \$1.00. MicA 55-1278

CHEMISTRY, ANALYTICAL

STUDY OF THE CHEMISTRY OF INTERHALOGENS AND POLYHALOGEN COMPLEXES IN NON-AQUEOUS SOLVENTS

(Publication No. 12,123)

Norman Edward Skelly, Ph.D.
State University of Iowa, 1955

Chairman: Dr. Alexander I. Popov

The dissociation constants for some polyhalide ions were determined in acetonitrile at 25° from absorption spectrophotometric data. The trihalide ion dissociates to yield an interhalogen compound and the corresponding halide ion. An attempt was made to determine the dissociation constant for the chlorobromiodide ion; however, the addition of excess chloride or bromide ion resulted in the quantitative formation of the dichloriodide and dibromiodide ions, respectively. Equilibrium dissociation constants found were the following: $(I_3^-)pK = 7.0$, $(IBr_2^-)pK = 7.3$, $(ICl_2^-)pK = 8.5$.

The electrical conductances of the interhalogens, iodine monochloride, iodine monobromide, iodine and cyanogen iodide were studied in acetonitrile. An increase in electrical conductance with time was observed for these four compounds. A special apparatus was constructed to study their electrical conductance in the absence of atmospheric moisture. However, the electrical conductance of iodine monochloride when studied in this apparatus continued to show an increase with time. These results together with those from spectrophotometric data seem to indicate a slow ionization, $2 ICl \rightleftharpoons I^+ + ICl_2^-$, for this compound in acetonitrile. In this solvent the three interhalogens were classified as weak conductors while cyanogen iodide was considered a non-conductor.

The electrical conductances of a number of polyhalogen complexes were studied in acetonitrile at 25° as a function of concentration. The complexes measured were the following: $(CH_3)_4NI_2$, $(CH_3)_4NIBr_2$, $(CH_3)_4NBr_3$, $(CH_3)_4NIBrCl$, $(CH_3)_4NI_3$, $(CH_3)_4NI_5$, $(CH_3)_4NI_6$, $CsICl_2$, $CsIBr_2$, CsI_3 , $RbICl_2$, PCl_6I , $(C_2H_5)_4NI_2$, $(C_3H_7)_4NI_2$, $(C_4H_9)_4NI_2$, $(CH_3)_4NCl$, $(CH_3)_4NBr$, $(CH_3)_4NI$. The polyhalogen complexes were found to be strong electrolytes in acetonitrile while the simple halides showed some association. This was determined from plots of S/Λ vs. c/Λ as taken from the Shedlovsky and Fuoss method.

Ion-pair dissociation constants and limiting conductances were calculated using this method.

Limiting ionic mobilities for the complexes were obtained by means of Walden's rule. The mobility of the tetraethylammonium ion in several solvents served as the basis for calculations. The polyhalide ions were found to have mobilities of the same order of magnitude as the simple halide ions.

The electrical conductances of several polyhalogen complexes were measured in ethylene chloride at 25° as a function of concentration. The complexes studied were the following: $(CH_3)_4NIBrCl$, $(C_3H_7)_4NIBr_2$, $(C_3H_7)_4NI_3$, $(C_3H_7)_4NI_5$, $(C_3H_7)_4NI_7$, $(C_4H_9)_4NI_2$, and $(C_4H_9)_4NBr_3$. Limiting conductances and ion-pair dissociation constants were calculated from plots of F/Λ vs. $c\Lambda f/F$ as taken from the Fuoss and Kraus method. The ion-pair dissociation constants were of the order of 2×10^{-4} .

Limiting ionic mobilities for the polyhalide ions were calculated using the limiting ionic mobilities for the cations taken from the literature.

The polyiodides studied were found to give the same limiting conductances in the respective solvents. This seems to indicate that the higher polyiodides do not exist as such in solution but immediately dissociate to the triiodide ion and the equivalent number of molecules of iodine. Previous spectrophotometric results indicate the same phenomenon.

121 pages. \$1.51. MicA 55-1279

CHEMISTRY, BIOLOGICAL

THE NATURE OF ACTION OF DEOXYRIBONUCLEASE ON DEOXYRIBONUCLEIC ACID

(Publication No. 12,257)

Jeanne-Marie Bergheim, Ph.D.
Stanford University, 1955

The hydrolysis of sodium thymonucleate by deoxyribonuclease from pancreas was studied over short intervals of time, of 4 to 14 hours, and over relatively long intervals, from 75 to 172 hours, in the presence of gelatin and of varying amounts of magnesium ion and of enzyme. The rate of liberation of acid groups titrating at pH 8 was determined in each case. A magnesium ion concentration of 4 micromoles per mg. of DNA and an enzyme concentration of 7 to 16 micromoles per mg. of DNA gave greatest acid liberation, approaching 1 equivalent per 3 moles of phosphorus over the long periods of digestion. After 4 to 6 hours, 75% of the final observed amount of acid had been liberated by enzyme action. Negligible amounts of acid were liberated in the absence of enzyme.

The digestion products obtained after 4, 6, 100, and 150 hours of DNase action were separated into 3 fractions which differed in their solubilities in aluminum sulfate solution at varying pH's. The two most

soluble fractions were analyzed for total phosphorus, purines, and pyrimidines. The fraction soluble at a pH near 2 was characterized by a low adenine content, of 3 to 6% of the total base of the fraction. The total amount of material soluble in the presence of aluminum ion between pH 2 and 4.6 represented 33% of the base of the digest after 150 hours of digestion, and 24%, after 6 hours. Sixty per cent to 70% of the base of the soluble fractions was thymine; after 15 hours of digestion 65% of the total thymine of the DNA substrate was present in soluble form. Adenine, guanine, and cytosine structures were relatively insoluble under all conditions applied.

The digests obtained after 14, 75, and 172 hours of DNase action were treated with prostatic phosphatase. The amounts of monoester phosphate groups liberated during digestion with DNase were determined and the products obtained after phosphatase action were separated by ion-exchange chromatography. One monoester phosphate group was present for each acid group titratable at pH 8 which had been liberated by DNase action. The fractions of the digests eluted from Dowex-2 (formate) columns with water and 0.05 N formic acid were isolated and analyzed; nucleosides, dinucleoside-monophosphate esters, and trinucleoside-diphosphate esters were identified by their base to phosphorus ratios and the proportions of individual bases present. Nucleoside and dinucleoside-phosphate esters containing guanine, adenine, cytosine, and thymine, and a trinucleoside fraction containing predominantly cytosine and thymine were obtained. The amounts of these structures varied according to length of digestion of DNA with the DNase. Guanine was absent from the nucleoside and dinucleoside fractions after 14 hours of digestion; trinucleoside esters were obtained only after 172 hours of DNase action. Thymine dinucleoside esters were slowly degraded by enzyme action to nucleosides. Di(cytosine deoxyriboside)-monophosphate and dithymidine-monophosphate were isolated and characterized as digest components after 14 hours of DNase action followed by treatment with prostatic phosphatase for 4 hours.

134 pages. \$1.68. MicA 55-1280

STUDIES ON CHONDROSAMINE-CONTAINING POLYSACCHARIDES

(Publication No. 12,052)

Eugene Abraham Davidson, Ph.D.
Columbia University, 1955

Chondrosine, a disaccharide obtained from cartilage chondroitin sulfate, has been prepared by an improved method and obtained in crystalline form for the first time. The disaccharide was characterized as a β -glucuronido-chondrosamine by reduction of the crystalline methyl ester hydrochloride with sodium borohydride to 3 (?)- β -D-glucopyranosyl 2-deoxy 2-amino D-galactitol, demonstrated by the isolation of glucose pentaacetate after N-acetylation and acid

hydrolysis. The N-acetyl derivative was hydrolyzed by β -glucosidase but not by α -glucosidase, thus indicating the configuration of the glucuronidic linkage.

Chondrosine was also converted to methyl hepta-O-acetyl-3 (?)- β -D-glucopyranosyl uronate) 2-deoxy 2-acetamido-D-galactitol identical in properties with the crystalline reduced acetate described by both Levene and by Wolfrom and co-workers. Chondrosaminol was obtained from both the glucosido-chondrosaminol and the reduced acetate and characterized as the N-dinitrophenyl derivative, thus confirming the structure of chondrosine as that of a glucuronido-chondrosamine.

The glucuronidic linkage of chondrosine was demonstrated to be 1-3. This was based on conversion of chondrosine to 2-(β -D-glucopyranosyl) D-lyxitol via the crystalline methyl ester hydrochloride which was oxidatively deaminated with ninhydrin. Reesterification and reduction with sodium borohydride yielded the glucosido-lyxitol, characterized as the crystalline octa-acetate.

Periodate studies on the amorphous free sugar demonstrated the consumption of four moles of periodate with the production of two moles of formic acid and one mole of formaldehyde. This indicated a 1-2 linkage for the glucosido-lyxitol, necessitating a 1-3 linkage in chondrosine and thereby in chondroitin sulfate and other polymers which contain chondrosine as the major repeating unit.

The hexosaminidic linkage in chondroitin sulfate is thought to be 1-4 on the basis of studies of enzymatic action on a partially degraded chondroitin sulfate and the similarity in the enzymatic degradation of chondroitin, a sulfate free or nearly sulfate free analog of chondroitin sulfate, to that of hyaluronic acid. A tentative structure is proposed for cartilage chondroitin sulfate.

A polysaccharide fraction isolated from bovine cornea contained equivalent amounts of hexosamine and uronic acid but was low in sulfate. By fractional elution from an ion exchange resin, it was separated into a high and a low sulfate fraction. The latter, on hydrolysis, yielded chondrosamine, identified by its optical rotation and crystalline 2-hydroxy naphthylidene derivative.

The deacetylated and desulfated repeating unit was prepared from the polysaccharide in high yield and crystallized. Its infra-red spectrum was identical with that of chondrosine prepared from chondroitin sulfate of hyaline cartilage.

The mucopolysaccharide was thus characterized as chondroitin, a sulfate free analog of chondroitin sulfate. Chondroitin was split by either testicular or pneumococcal hyaluronidases at the same rate to the same type and distribution of end products as hyaluronic acid. This demonstrated the lack of specificity of either testicular or bacterial hyaluronidases with regard to the amino sugar moiety. Studies on a partially desulfated, partially degraded chondroitin sulfate indicated that the failure of bacterial hyaluronidases to attack chondroitin sulfate may be ascribed to the presence of the sulfate group. A structure is proposed for chondroitin analogous to that of chondroitin sulfate.

An improved method for the preparation of chondroitin sulfate B, that of tendon, skin and heart valves, is described. The polysaccharide was shown to be distinctly different from chondroitin sulfate of cartilage or umbilical cord. Some preliminary investigations are discussed.

103 pages. \$1.29. MicA 55-1281

MACROMOLECULAR INTERACTIONS

(Publication No. 11,932)

Seymour Ehrenpreis, Ph.D.
New York University, 1954

Adviser: Robert C. Warner

The interaction of two crystalline egg white proteins, conalbumin and lysozyme has been studied by equilibrium dialysis, electrophoresis, precipitate analysis, spectrophotometry, optical rotation and ultracentrifugation. Dialysis was performed with ZnCl_2 treated membranes which permitted diffusion of the lysozyme but were impermeable to the conalbumin. A plot of the dialysis data according to Scatchard's method is most simply interpreted in terms of the formation of two complexes with a ratio of conalbumin to lysozyme of 1:1 and 1:2. Dissociation constants of 5.7×10^{-5} and about 10^{-3} moles/liter respectively were derived. The electrophoretic patterns exhibited two boundaries in each channel over a wide range of ionic strengths, protein concentration and pH. The slower of these boundaries moves with a constituent mobility of the component which disappears across the boundary and by its mobility and area reflects the formation of complex. Data derived from the areas of the patterns were in good agreement with the dialysis results. On this basis it was concluded that interaction is enhanced by lowering the ionic strength and is primarily electrostatic. Variation in protein concentration ratio at constant ionic strength and pH produces concomitant changes in areas and mobility. The effect of pH is difficult to evaluate although interaction is much diminished when both proteins are positively charged. In all cases the ascending mobilities were found to be the same as that of the pure component. Application of the equations of Alberty and Marvin revealed a 1:1 complex under most conditions.

The effect of current reversal can best be interpreted on the basis of complete and rapid reversal of all equilibria.

Precipitate formation was only apparent on prolonged standing at low temperature and ionic strength.

The absorption spectrum of iron conalbumin was unchanged by interaction with lysozyme. No change in the optical rotation could be detected as a result of complex formation although other systems exhibiting electrostatic interaction showed considerable changes in rotation.

An ultracentrifugal analysis of a mixture revealed two components with conalbumin sedimenting at a rate about ten per cent greater than when pure.

The preparation and properties of a dialyzable yeast nucleic acid have been described. A small degree of binding to conalbumin and ovalbumin has been demonstrated by equilibrium dialysis and electrophoresis. The anomalous slow diffusion rate of this YNA dialysate has been ascribed to interaction among individual YNA molecules rather than to the presence of an interacting protein.

117 pages. \$1.46. MicA 55-1282

STUDIES ON THE ACTION OF A BACTERIAL alpha-AMYLASE ON AMYLOPECTIN FROM WAXY MAIZE

(Publication No. 11,625)

Donald Franklin Emery, Ph.D.
Purdue University, 1955

Major Professor: Ralph C. Corley

The ability of the alpha-amylases to hydrolyze the α -1,4-glucosidic bonds in the vicinity of the α -1,6 branch links of amylopectin has been a subject of considerable controversy. The availability of a purified preparation of the alpha-amylase produced by Bacillus subtilis afforded an opportunity to study the action of still another alpha-amylase in this respect. The substrate was waxy maize starch, which has been shown to be essentially free of amylose.

An additional purification of the enzyme preparation was carried out, and the absence of beta-amylase or maltase action was established. Some of the properties and general reaction characteristics of the twice-purified enzyme preparation were then investigated. The ultraviolet absorption spectrum of the enzyme protein was determined, and it was found to be similar to that of other alpha-amylases. The only notable difference was the presence of two absorption peaks in the region of the aromatic amino acids, where it has been reported that certain other alpha-amylases possess only one absorption maximum. A study of reaction conditions then indicated that the enzyme did not require the addition of calcium ion for activity and that pH and temperature optima for the system were 6.0 and 50° C., respectively.

The general pattern of hydrolysis was followed by periodically determining the quantity of reducing sugar present during the course of enzyme action. This examination was carried out on the waxy maize starch and on its beta-dextrin. In each case the resulting rate curve possessed the two phases (dextrinization and saccharification) which are characteristic of other alpha-amylases. A determination of initial velocities of hydrolysis at four different substrate concentrations permitted the calculation of a Michaelis constant, K_s , for the action of this alpha-amylase on waxy maize amylopectin. The value thus obtained was 4.2 micro-equivalents of glucosidic bonds per ml.

Hydrolysis was stopped by heat inactivation of the enzyme at various stages of hydrolysis, and the products occurring at these stages were determined by means of paper chromatography. This information

was related to the general mode of action of the enzyme. In addition, it was noted that the enzyme was apparently unable to hydrolyze the 1,4 linked triose, maltotriose.

In order to obtain an indication of the activity of the enzyme in the vicinity of the 1,6 branch links, it was necessary to establish the location of these 1,6 links in the various products of complete hydrolysis. A number of complete hydrolysates were prepared by allowing enzyme action to continue until the addition of fresh enzyme could produce no further increase in reducing power of the hydrolysate. A sample of each was paper chromatographed. In no case was the presence of a 1,6 linked saccharide of two, three, or four glucose units per molecule indicated. Glucose, maltose, maltotriose, and an isomaltopentaose (a 1,6 branch-linked pentaose) were present in all hydrolysates. Isomaltohexaose was present in almost all hydrolysates.

The products of hydrolysis were then separated by carbon-celite column chromatography and by separative filter paper chromatography. The DPn (degree of polymerization) was determined for each of the oligosaccharide products indicated by paper chromatography to be in the DPn range of five to six. It was thus established that the oligosaccharides believed to be maltopentaose, isomaltopentaose, and isomaltohexaose were pentaose, pentaose, and hexaose, respectively. Partial acid hydrolysis and subsequent paper chromatography of each of the latter three oligosaccharides indicated that the latter two contained a 1,6 link, whereas the first contained only 1,4 bonds.

Thus, the final products of complete amylolysis appeared to be glucose, maltose, maltotriose, and an isomaltopentaose. It is possible that isomaltohexaose should also be considered as a final product. The identification of isomaltopentaose as the smallest 1,6 branched oligosaccharide produced by the enzyme indicated that the 1,4 bonds immediately adjacent to a 1,6 bond are rendered stable to alpha-amylase action. At the very least, it may be stated that the affinity of the enzyme for a 1,4 bond immediately adjacent to a 1,6 bond appears to be so low that under normal conditions very little, if any, hydrolysis of such bonds is possible.

99 pages. \$1.24. MicA 55-1283

STUDIES ON THE MODE OF ACTION OF SYNTHETIC THYROPROTEIN

(Publication No. 12,141)

Wallace Friedberg, Ph.D.
Michigan State University, 1953

Studies were conducted with the view of increasing our knowledge of the mode of action of synthetic thyroprotein in the living body. The thyroprotein used was I-131 labelled iodinated casein. The first experiment was a comparative study of the distribution of iodinated casein and iodide in various tissues of the rat. Radioiodide and iodinated casein

were administered, intravenously, to two groups of rats. One hundred minutes after the injections the animals were sacrificed and tissue samples were taken. Higher concentrations of iodinated casein than iodide were found in the liver, spleen, kidney, lung, stomach, and small intestine. The highest concentration was found in the liver, where it was more than 10 times that of the iodide. Slightly iodinated casein (1-2% iodine) was studied similarly and was found to concentrate in the same tissues which were shown to concentrate iodinated casein. The slightly iodinated casein was not as concentrated in the liver, but more concentrated in the stomach and large intestine, than the iodinated casein.

The metabolic breakdown of intravenously administered iodinated casein was studied with a view toward characterizing the metabolites and determining their relative concentrations over a time series. The alkali washed butanol extract was considered to contain the thyroxine-like iodine. The free thyroxine-like iodine was that which could be extracted before hydrolysis of a tissue sample. Combined thyroxine-like iodine was that which was extractable after the free thyroxine-like iodine had already been extracted and the tissue sample hydrolyzed in 2N sodium hydroxide. The time intervals studied were 1½, 12, 24, and 72 hours. The results indicated that thyroxine-like iodine was hydrolyzed from the iodinated casein, in the liver, and released to the plasma. The amount of iodinated casein available to the liver and the plasma level of thyroxine-like iodine were found to be interdependent.

Orally administered iodinated casein was studied in rats in order to characterize the iodine absorbed into the plasma, and to determine the relationship between the time interval after oral administration of the thyroprotein and the concentration of thyroxine-like iodine in the plasma. The time intervals studied were 1½, 12, and 48 hours. More than 50 percent of the thyroxine-like iodine appearing in the plasma at all time intervals after oral administration, was in the free butanol soluble form. However, the data suggest that small amounts of thyroxine-like iodine, in a combined form, are absorbed from the intestinal tract. The highest percent of combined thyroxine-like iodine was found at the first time interval (1½ hour). This may represent the intact protein or some large metabolite.

The influence of plasma iodinated casein on urine radioactivity was studied by measuring the decreases in plasma and urine radioactivity in the dog. Iodinated casein was found to be rapidly cleared from the plasma while the urine radioactivity showed a slow, but steady, decrease. A characterization of the radioactive material in the urine, 25 minutes after the intravenous administration of iodine-131 labelled iodinated casein revealed it to be undialyzable. The radioactivity in the urine may represent the intact iodinated protein or some large metabolite.

90 pages. \$1.13. MicA 55-1284

GROWTH AND NITROGEN METABOLISM OF
CERTAIN LEGUMES, WITH SPECIAL REFERENCE
TO THE EFFECTS OF
CONTROLLED ENVIRONMENTS

(Publication No. 11,904)

Nathanaël Grobbelaar, Ph.D.
Cornell University, 1955

The thesis is organized in three parts namely:

Part I

A brief review is given of the discovery and chemical characterization of the amino acids and proteins in plants, with special reference to discoveries made by the use of paper chromatographic methods in recent years.

A novel procedure, suitable for large-scale isolation of L(-)-pipecolic acid from plant material is described. Modifications that render an existing quantitative paper chromatographic method suitable for the determination of pipecolic acid are also described.

Evidence is presented for the derivation of L(-)-pipecolic acid from L-lysine in vivo. The results obtained with *Phaseolus vulgaris* are discussed in relation to the knowledge of lysine metabolism in other organisms.

The detection, isolation and partial identification of a compound, believed to be 5-hydroxypipecolic acid, in the seed of *Baikiaea plurijuga* is announced. The occurrence of this compound in large amounts in the seed together with baikiain and pipecolic acid stimulated speculation as to their possible biochemical relationships.

The occurrence of high concentrations of homoserine in pea shoots is confirmed by paper chromatographic techniques. The detection, purification and partial identification of a compound in pea shoots that appears to be a close derivative of homoserine are described.

Part II

A brief review of the literature dealing with the changes that occur in the nitrogenous composition and metabolism of plants during development is presented. Special consideration is given to some recent work performed on the pea (*Pisum sativum* L.) in South Africa.

Part III

A brief review of the known effects of light and temperature on plants is presented. New results of the effects of different controlled environments on the growth and nitrogen composition of four varieties of peas (Green Feast, Swartbekkie, Unica and Vinco), are described.

It is shown that whereas the 8 hour per diem temperature treatments had very little effect on the growth and morphology of the plants, the 16 hour treatments caused pronounced growth responses. In the 16 hour treatments the plants grown at the lower

temperatures developed slower, aborted fewer floral buds and were considerably heavier and more robust than the plants from the higher temperature treatments.

The plants that received 8 hour photoperiods (sunlight) branched considerably more than the plants that received 16 hour photoperiods (artificial light).

The Green Feast, Swartbekkie and Unica varieties behaved as long-day plants in that they produced first-flower primordia at lower nodes under 16 hour photoperiod conditions than under 8 hour photoperiod conditions. Photoperiod did not affect the nodal position of the first-flower primordia of the Vinco plants.

The 16 hour per diem temperature treatments also had a pronounced effect on the nodal position of the first-flower primordia of the Green Feast, Swartbekkie and Unica peas. In these cases, flower initiation was delayed at the higher temperatures. The nodal position of the first-flower primordia of the Vinco plants was not affected by temperature.

It is shown that the environments that do significantly affect the growth and morphology of the plants also have some effect on the nitrogenous composition of the plants so grown.

Attempts are made to explain the apparent general lack of correlation in most cases between the experimental variables or growth responses and the nitrogenous composition of the plants as it was observed at the onset of fruiting. A striking and orderly effect of temperature on the concentration of asparagine, homoserine and an unidentified compound, closely related to homoserine, was however noted in some cases.

389 pages. \$4.86. MicA 55-1285

STUDIES ON THE AMINO ACID COMPOSITION
OF SOME HISTONES: CHARACTERIZATION OF
TERMINAL AMINO ACID RESIDUES
AND PARTIAL HYDROLYSIS PRODUCTS

(Publication No. 12,266)

Melvin Irwin Haley, Ph.D.
Stanford University, 1955

Several procedures, employed in this laboratory, for the preparation of histone were used in preparing material for terminal residue and peptide studies. Histone was prepared in one instance from a non-fibrous preparation of desoxypentosenucleohistone. A second method of preparation was employed satisfactorily, using ethylene glycol to isolate the nuclei of calf thymus. Hurd's modification of the ethylene glycol method in which propylene glycolcitrate was substituted was also employed to facilitate the isolation of the nuclei from rat liver. The isolated histone was separated into a light and a heavy fraction by centrifugation.

From whole, light, and heavy histone from calf thymus, and histone from rat liver, dinitrophenyl derivatives were prepared. The protein content of the dinitrophenylhistones was determined from the amide nitrogen content and from the amino acid composition of histone.

The dinitrophenyl derivatives were extracted with ether from the dinitrophenylhistone hydrolysate. The preferred method of hydrolysis was to use 12 N HCl in a sealed glass tube. The dinitrophenyl derivatives were separated on a silicic acid column. The dinitrophenylamino acids isolated were compared with authentic specimens of dinitrophenylamino acids. One-dimensional paper strip chromatography was also employed to determine the dinitrophenylamino acids extracted from the dinitrophenylhistone hydrolysate. The amino acids detected as N-terminal residues were found to be alanine, valine, leucine, and glycine. The proportions of these amino acids in the various histones were determined.

The C-terminal residues of histone were determined by the use of carboxypeptidase. The liberated amino acids were allowed to react with dinitrofluorobenzene to form the dinitrophenyl derivatives of the liberated C-terminal amino acids. These dinitrophenylamino acids were isolated and identified by using silicic acid columns. The C-terminal amino acids identified were alanine, valine, leucine, and tyrosine. The proportions of these amino acids in the various histones were determined.

From the N-terminal and C-terminal amino acids isolated and estimated, it was possible to calculate a minimum molecular weight for the histones. The minimum molecular weights calculated from these data were within the range of 7,500 to 9,400.

Since the histone preparations appeared to be heterogeneous, attempts were made to isolate a single peptide chain or to fractionate the dinitrophenylhistone. Two methods were applied to this problem. First an attempt was made to separate histone by paper electrophoresis. One zone moved ahead of the rest of the protein. This fast-moving zone was isolated and the peptide therein was found to have a single N-terminal residue, alanine. The other fractions on the paper were shown to have several N-terminal residues and indicated poor separation which may have been due to the excessive tailing and binding to the paper. The second method used was based on dimethyl formamide extraction of the dinitrophenylhistone. Approximately one-third of the dinitrophenylhistone was extracted with dimethyl formamide. The N-terminal residues were identified after hydrolysis of the dinitrophenylhistone. The N-terminal residues of the extracted and insoluble fractions were compared. No single peptide chain was isolated; however, glycine and leucine were absent as N-terminal residues, or nearly so, in the dimethyl formamide-extracted fraction.

The partial hydrolysis of the dinitrophenylhistone resulted in the isolation of several bands on a silicic acid column. These bands corresponded to di-, tri-, and tetrapeptide bands. The tri- and tetrapeptide bands had several N-terminal residues which indicated the presence of several peptide derivatives. The dipeptide band had only dinitrophenylvaline as the N-terminal residue. This dipeptide was identified as di-dinitrophenylvalyllysine.

Heavy histone was found to be lacking in valyllysine as an N-terminal peptide.

120 pages. \$1.50. MicA 55-1286

SOME PHYSICAL PROPERTIES OF BETA-LACTOGLOBULIN

(Publication No. 11,980)

Robert Mathew Hill, Ph.D.
University of Minnesota, 1955

The binding of sodium-n-octylbenzene-p-sulfonate by β -lactoglobulin has been studied in 0.1 ionic strength phosphate buffer at pH = 6.8, utilizing the methods of equilibrium dialysis and electrophoresis. Free detergent concentrations less than the critical micelle concentration were employed in this study. It has been demonstrated that while equilibrium can be established across a cellophane membrane when the final detergent concentration is above the critical micelle value, the length of time required prohibits its use with protein solutions which tend to deteriorate. It appears that the binding of detergent occurred in three stages. The first stage followed mass action relationship for which the intrinsic dissociation constant was 1.59×10^{-5} and was limited to the binding of 2 to 3 moles of detergent per mole of protein. As this binding process approached saturation, a physical change occurred in the protein molecule resulting in the exposure of about 22 more binding sites with different dissociation characteristics than those involved in the first stage and following a second mass action relationship. The intrinsic dissociation constant for this stage of binding was found to be 2.32×10^{-4} . It was considered that the conversion of the protein was an all or none process with respect to a given protein molecule. The binding of detergent by either the first or second step increased with increasing free detergent concentration. After an average of about 2.5 moles of detergent have been bound by each mole of protein, a second component, electrophoretically faster than the first, appeared in the electrophoresis patterns and finally at higher concentrations the slow peak disappeared altogether. Further increase of detergent concentration increased the mobility of this component but did not cause the formation of any new one. The binding beyond this level was considered to be primarily of a micellar type. An equation was presented which described the entire binding isotherm up to the critical micelle concentration of the free detergent. Reversibility studies showed that at high levels (i.e. at free detergent concentrations beyond the point where all the protein has been converted to the second form) the same point on the binding curve may be reached from either direction, but at levels where the first and second stages are involved a hysteresis was observed. This showed that the protein, once it was "opened-up," tended to be maintained in that condition and that binding according to the second step probably tended to keep it in the "open" configuration. However, it was possible to remove all of the detergent by extended dialysis whereupon the protein acted exactly as the native form in its tendency to bind this detergent once again. Protein which had been exposed to detergent resisted all attempts to crystallize it after removal of the detergent. Thus, the unique configuration may be destroyed upon the opening up of the molecule and not reformed when refolding occurs, yet

the course of readsorption of the detergent by the "regenerated" protein was identical with that of the nature protein.

The heat denatured form of this protein was found to bind less of the detergent than did the native at equivalent free detergent concentrations. The primary binding step appeared to be absent from its adsorption isotherm, and it was concluded that only the second and third manners of interaction were involved here. A theoretical isotherm was calculated based on this assumption and it gave good agreement with the experimental data. The limiting number of sites available for the second step according to this relationship was 15.2, and the intrinsic dissociation constant was 6.3×10^{-4} . At higher concentrations, micelle type binding again occurred.

The adsorption curve for ovalbumin and the same detergent was determined. It was observed that a three stage binding process occurred here also. In this case, however, only one detergent molecule was bound to each protein molecule in the first step.

Evidence was presented to demonstrate that a heterogeneity existed among the native protein molecules with respect to their ability to undergo the "opening-up" process.

207 pages. \$2.59. MicA 55-1287

STUDIES ON THE FRACTIONATION AND DEGRADATION OF MAMMALIAN DEOXYRIBONUCLEIC ACIDS

(Publication No. 12,059)

Marion Edward Hodes, Ph.D.
Columbia University, 1955

I. Procedures are presented for the nearly quantitative removal of the purines from calf thymus deoxyribonucleic acid that are not accompanied by a complete destruction of the original highly polymerized structure, or by changes in the distribution of the pyrimidine nucleotides. The designation apurinic acid (APA) was proposed for non-dialyzable preparations of this type. The composition and some of the properties of apurinic acid are described.

II. The preparation of moderately large amounts of some of the fractions of calf thymus deoxyribonucleic acid, differing in the ratio of adenine plus thymine to guanine plus cytosine, is described. Apurinic acids have been prepared from these fractions, as well as from fractionated and unfractionated human spleen deoxyribonucleic acid, and their compositions investigated. The first detailed description of the occurrence of 5-methyl cytosine in human tissues is reported. The course of the splitting of adenine and guanine from deoxyribonucleic acid by dilute acid is described.

III. Enzymic studies on the nature of the residue remaining after alkali treatment of calf thymus apurinic acid are presented, showing the alkali residue to consist of a polynucleotide-like structure. The preparation and analyses of the alkali residue of

human spleen apurinic acid, and of the apurinic acids of calf thymus deoxyribonucleic acid fractions are outlined, and their significance for an understanding of the structure of deoxyribonucleic acid discussed. It is thus confirmed that deoxyribonucleic acid apparently consists of stretches of predominantly purine nucleotides alternating with stretches of predominantly pyrimidine nucleotides.

IV. The residues remaining after extensive degradation of calf thymus deoxyribonucleic acid fractions by pancreatic deoxyribonuclease are described, and their significance discussed.

72 pages. \$1.00. MicA 55-1288

TRACER STUDIES ON THE PATHWAY OF THE BIOLOGICAL CONVERSION OF GLUCOSE TO ASCORBIC ACID

(Publication No. 12,060)

Hugh Harris Horowitz, Ph.D.
Columbia University, 1953

A survey of the literature on the biological origin of ascorbic acid reveals that while a carbohydrate precursor was generally supposed, no conclusive evidence for any particular one was obtained until radioactive work at Columbia University showed that glucose was a precursor in the chloretone stimulated albino rat. That experiment, however, did not distinguish between the routes whereby the conversion of glucose to ascorbic acid can take place. The present work shows that glucose is converted directly to ascorbic acid, without chain fragmentation and with maintenance of the steric configuration, through the probable intermediacy of glucuronic acid.

Male albino rats were used as the test animals in these experiments. They were given daily doses of chloretone by stomach tube until the daily urinary excretion of ascorbic acid reached a high level. They were then injected with a solution of carbon-14 labeled carbohydrate - either glucose-1- C^{14} , glucose-6- C^{14} or uniformly labeled glucuronolactone. The glucose-1- C^{14} was synthesized by the addition of radioactive cyanide to D-arabinose in basic solution, separation of the diastereoisomeric aldonic acids and reduction of the gluconolactone with sodium amalgam to glucose. The other two substances were prepared in other laboratories.

The urines, collected for 24 hours after each injection, were worked up so as to yield crystalline ascorbic acid, purified principally by absorption on and elution from an anion exchange column. The osazone of ascorbic acid was prepared from the crystalline material.

After the total amount of radioactivity in the ascorbic acid was determined, the amount of radioactivity in each carbon was assayed as follows: Carbon 1 was determined by decarboxylation yielding CO_2 . Carbons 5 and 6 were obtained as formic acid and formaldehyde respectively, after an alkaline cleavage of the osazone with periodate. For counting

purposes the formate was isolated as CO_2 and the formaldehyde as its dimedon derivative. Hypiodite cleavage of the ascorbic acid yielded oxalate, isolated as its calcium salt, representing carbons 1 and 2. The threonate also formed in this cleavage was treated with periodate to yield CO_2 from carbon 3, formic acid from carbons 4 and 5 and formaldehyde from carbon 6, both isolated as above. Thus, carbons 1, 3, 5 and 6 were isolated individually and carbons 2 and 4 were obtained by difference from the total in a 2 carbon fraction. The radioactive purity of all the isolated organic compounds, as well as the ascorbic acid and the glucoses, was demonstrated by recrystallization, except for the oxalate, which was sublimed in one case and ether extracted in another.

Using the above procedure, it was found that glucose-1- C^{14} was converted to ascorbic acid with 60% of its activity in the 6 position. Conversely, glucose-6- C^{14} yielded ascorbic acid with 60% of its activity in the 1 position. The yields from the two glucoses were approximately equal. Direct conversion was thus indicated. The lesser amounts of activity in the other positions were probably due to equilibration of the radioactivity among the carbons of glucose before ascorbic acid formation.

The ascorbic acid isolated after administration of C^{14} glucurone was not radioactively pure due to contamination by some of the large amount of glucurone that the animals excreted unchanged in the urine. Recolumning and recrystallization brought it to constant activity, however, and its radioactive purity was then also demonstrated using paper strip chromatography of the radioactive materials involved. The radioactive yield of ascorbic acid from glucurone was about 4 times as large as that from either of the C^{14} glucoses. Degradation of the ascorbic acid from the animals given uniformly labeled glucurone showed uniform labeling, indicating direct conversion.

All the facts given here fit into the postulated conversion scheme: glucose is converted to glucurone (already shown by other investigators), which is then converted to ascorbic acid, all with maintenance of the steric configuration.

69 pages. \$1.00. MicA 55-1289

THE ROLE OF COBALT IN THE RUMINANT ANIMAL

(Publication No. 12,038)

Ronald Roy Johnson, Ph.D.
Columbia University, 1954

Adviser: Alvin L. Moxon

The demonstration at the Ohio Agricultural Experiment Station of a response to cobalt in poor roughage rations for fattening steers prompted further studies on the synthesis of vitamin B_{12} active substances by rumen microorganisms.

Bovine rumen microorganisms were incubated *in vitro* on a purified medium containing inorganic Co^{60} .

The vitamin B_{12} active substances produced in this medium were separated by electrophoresis on filter paper. The locations of the active substances were determined by bioautography, using *Escherichia coli* 11105, and radioautography, using X-Ray film.

At least six and possibly seven or eight vitamin B_{12} active (microbiologically) substances of different electrophoretic mobility were synthesized by bovine rumen microorganisms *in vitro*. Five of these substances contributed the major portion of the total vitamin B_{12} activity in the sample. Two of the substances were identified as being vitamin B_{12} and vitamin B_{12b} ; the remainder were unidentified. Co^{60} was incorporated into all of the vitamin B_{12} active substances.

Six vitamin B_{12} active substances were synthesized by the microorganisms in the rat intestine. These six compared in mobility with six similar substances found in rumen liquor.

Four vitamin B_{12} active substances have been demonstrated in rat kidney and sheep liver and kidney. Two of these substances were also identified as vitamin B_{12} and vitamin B_{12b} . The other two substances were unidentified but were identical in mobility and probably chemically with two of the major vitamin B_{12} active components in rumen liquor and rat feces. It seems probable that they occurred in the animal tissues as a result of absorption from the gastrointestinal tract.

Paper electrophoretograms were cut into sections containing the various vitamin B_{12} substances as located by autographic means. The water extract of each section was assayed for vitamin B_{12} activity, using the *Lactobacillus leichmannii* 7830 titrimetric assay. Vitamins B_{12} and B_{12b} contributed from 35 to 80 per cent of the total vitamin B_{12} activity in samples of rumen liquor and of feces from steers, sheep, and rats.

When both *E. coli* and *L. leichmannii* were used to assay samples of rumen liquor and rat feces, no significant differences in the two assay values were obtained. Small differences were noted when some of the individual substances resembling vitamin B_{12} were assayed with the two organisms.

The addition of massive doses of crystalline vitamin B_{12} to rumen flora fermentations *in vitro* did not inhibit the synthesis of the other vitamin B_{12} active substances. The evidence indicated the possibility that some vitamin B_{12} was converted to one or more of the other forms. Adding readily available sources of carbohydrate (such as starch) to the rumen fermentation did not change the relative proportions of the vitamin B_{12} active substances.

Inorganic cobalt was placed in the intact rumen of a sheep and samples of rumen content and feces were analyzed. Sheep rumen microorganisms produced vitamin B_{12} active substances *in vivo* that were similar in mobility to, and probably identical with, those produced by the bovine rumen microorganisms *in vitro*.

The evidence shows that the vitamin B_{12} active substances synthesized by rumen microflora are very similar to those produced by the microflora in the gastrointestinal tract of the rat — a monogastric animal.

131 pages. \$1.64. MicA 55-1290

THE REACTION OF IODINE WITH BRANCHED POLYGLUCOSANS

(Publication No. 11,942)

Kenneth C. Leibman, Ph.D.
New York University, 1954Advisers: Dr. Isador Greenwald and
Dr. Robert C. Warner

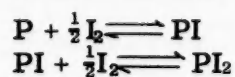
Although the nature of the reaction between iodine and the linear polyglucosan amylose forming the familiar blue complex has been thoroughly investigated by Rundle and his associates, the reactions between iodine and the branched polyglucosans such as glycogen and amylopectin, forming red to violet complexes, have received no such attention. It is hoped that the present work will to some extent help to fill this void.

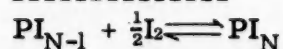
Preliminary qualitative spectrophotometric investigations showed that a fundamental difference exists between the mechanisms of reaction of iodine with linear and branched polyglucosans. Such differences were especially apparent when the effects on the spectra of the concentration of salts, and in particular of iodides, were studied. The action of potassium iodide upon the glycogen - iodine reaction may be broken up into two phenomena, a "salt effect" and an "iodide effect," the former enhancing the color formation, and the latter inhibiting it.

Quantitative studies of the equilibrium between iodine and branched polyglucosans were made by the method of equilibrium dialysis. A mathematical treatment of the data has been devised. The data in the cases of 1,6-branched 1,4-polyglucosans, such as the glycogens and amylopectins, were found to be described by the equation

$$r = NKc^{\frac{1}{2}} / (1 + Kc^{\frac{1}{2}})$$

where r is the concentration of bound iodine, c is the concentration of free iodine, N is the value of r at saturation, and K is the intrinsic equilibrium constant. From this it has been inferred that the consecutive equilibria involved are





where P is the polyglucosan molecule, and that the reacting species is the iodine atom, or some other entity whose concentration varies proportionally to the square root of that of molecular iodine.

By similar reasoning, it was concluded that in the case of the 1,4-branched 1,6-polyglucosan dextran, which forms no colored complex with iodine, the reacting species is the iodine atom, or some other species whose concentration is in direct proportion to that of iodine.

Limited experiments were performed to show that at higher temperatures, the capacity of glycogen to react with iodine becomes greater, while the free energy of reaction of each individual iodine atom is lowered. It was also shown that the molar

iodine-saturation point of glycogen varies inversely with the glycogen concentration. In addition, results of quantitative studies on the effect of the concentration of potassium iodide were shown to be in accord with the preliminary qualitative observations. The implications of these findings are discussed.

A correlation was demonstrated between the amount of iodine which may be bound by a mole of branched polyglucosan and the number of terminal non-reducing glucose residues per mole. Such a correlation was taken to indicate that iodine is bound only at the outer ends of the exterior chains of the molecules.

79 pages. \$1.00. MicA 55-1291

CHARACTERISTICS AND MODE OF ACTION OF CHOLINE ACETYLASE

(Publication No. 12,067)

Ruth Berman Reisberg, Ph.D.
Columbia University, 1955

The enzyme choline acetylase, which catalyzes the synthesis of acetylcholine from acetyl-CoA and choline, was extracted from acetone dried powders prepared from Squid head ganglion. The extract was purified, using protamine sulfate and ammonium sulfate fractionations, and adsorption on calcium phosphate gel. This freed it from most of the interfering deacylase activity. Assay methods such as the nitroprusside reaction for sulfhydryl groups, the hydroxylamine reaction with esters and a bioassay for acetylcholine utilizing the frog's rectus abdominus muscle, were adapted to the study of this enzyme.

Optimum conditions for the activity of choline acetylase were determined. The K_m for acetyl-CoA was found to be 1.6×10^{-3} ; for choline it was 5×10^{-4} . The pH optimum of the enzyme preparation used was 6.8, and the temperature optimum was 30°C .

Sulfhydryl groups were found to be essential for the activity of this enzyme, and oxidizing, alkylating and heavy metal containing compounds all strongly inhibit the activity. O-Iodosobenzoate inhibits at 10^{-5} M , iodoacetate at $5 \times 10^{-4} \text{ M}$, and p-chloromercuribenzoate at $2 \times 10^{-6} \text{ M}$.

The specificity of the enzyme in regard to the two groups with which it combines, the amino alcohol and the acyl group, was determined. In regard to the alcohols, the enzyme was found to be almost completely specific for choline, which is acetylated over sixteen times as well as the dimethyl compound, and more than fifty times as well as the monomethyl-ethanolamine. Of the acyl groups studied, propionyl-CoA was utilized almost as well as acetyl-CoA, but butyryl-CoA reacted only fifteen to twenty per cent as well.

The inhibitory action of compounds analogous to the major natural substrates, choline and acetyl-CoA, was investigated. For the choline site, inhibition was found with tetramethyl ammonium chloride, trimethylamine HCl, dimethylamine HCl, prostigmine and its tertiary analogue, tubocurarine, and

decamethonium. For the acetyl-CoA site, the compounds showing inhibitory activity include butyryl-CoA (3.2 μ M inhibits about 35 per cent), benzoyl-CoA (0.42 μ M inhibits 25 to 35 per cent), and hippuric acid (70 μ M inhibits about 25 per cent).

The enzyme was activated during the course of the reaction by the addition of a metal binder, ethylenediaminetetraacetate, and a reducing agent, usually containing a sulfhydryl group. Storing the enzyme with these activators had no effect on its activity.

The reaction was not linear with time, and the possible inhibitory effects of the products of the reaction were investigated. Four μ M of added CoA inhibited the reaction about one third, while fifty μ M of added acetylcholine inhibited it about forty per cent. When a system removing CoA liberated during the course of the reaction was added, such as the phosphotransacetylase acetyl phosphate system, the rate of the reaction was greatly increased, and the reaction became linear with time.

Possible reaction mechanisms, involving the sulfhydryl group on the coenzyme and the relation of the enzyme to the coenzyme, are suggested and discussed.

84 pages. \$1.05. MicA 55-1292

THE AMINO ACID COMPOSITION OF RUMEN AND INTESTINAL LIQUOR FRACTIONS FROM SHEEP ON PURIFIED AND NATURAL RATIONS

(Publication No. 12,280)

Elwin J. Richardson, Jr., Ph.D.
Cornell University, 1955

The general objective of this research is a study of the processes occurring in the rumen and intestine by which food nitrogen becomes available to the ruminant in the form of "essential" amino acids.

The method of approach is (a) to study the distribution of nitrogen between the nitrogen-containing fractions of the rumen and intestinal liquor, (b) to determine quantitatively and qualitatively the amino acid composition of the protein fractions, and (c) to isolate and identify the soluble non-protein nitrogen compounds found in the free state in the rumen and intestinal liquor.

The study is made on rumen and intestinal contents from sheep on both natural hay and purified rations (with urea as the sole source of nitrogen).

The rumen and intestinal liquor are separated into four fractions (food residue, microorganisms, soluble protein, and non-protein nitrogen) by selective centrifugation and precipitation with alcohol. The nitrogen content of each fraction is determined by the micro-Kjeldahl method. The amino acid content of hydrolysates of the protein fraction and the non-protein nitrogen fractions are determined chromatographically.

The results show that a large proportion of the nitrogen in rumen and intestinal liquor from sheep on both diets is found in the microbial fraction. This confirms the belief held that food nitrogen is partially

converted to bacterial nitrogen before it is utilized by the ruminant. The large proportion of nitrogen found in the microbial fraction indicates that the conversion is at a high level.

The amino acid composition of hydrolysates of the microbial and protein fractions is found to be essentially the same, indicating the microorganisms as the source of the protein. A comparison of the amino acid composition of hydrolysates of fractions from sheep on both purified and hay rations shows little variation, quantitatively or qualitatively.

Analysis of the non-protein nitrogen fraction from the rumen with the hay ration shows a general distribution of amino acids, while analysis of that from the purified diet is characterized by relatively large quantities of glutamic acid, alanine, glycine, and lysine. Possible explanations for their appearance are given.

Analysis of the non-protein nitrogen fraction of intestinal liquor from sheep on both purified and hay rations are characterized by their content of peptide material which disappears on hydrolysis.

58 pages. \$1.00. MicA 55-1293

STUDIES ON THE METABOLISM OF MAMMARY GLAND TISSUE DURING GESTATION AND LACTATION

(Publication No. 11,917)

Ira Ringler, Ph.D.
Cornell University, 1955

An attempt has been made to further enumerate upon the metabolic patterns of mammary gland tissue during its various structural and functional stages.

Coenzyme A has been measured in mammary gland tissue during gestation, lactation and involution. The concentration of this cofactor varies from 0 to 45 Lipmann units per gram dry weight tissue during gestation. The lowest values correspond to the early stages of pregnancy, the higher values being reached prior to parturition. After parturition a sharp increase in coenzyme A concentration takes place reaching maximum values on about the fifth day postpartum (126-150 Lipmann units). By the 40th day postpartum the coenzyme A levels had dropped to 27-40 Lipmann units.

Diphosphopyridine nucleotide (DPN) concentrations show much less variation between the gestation and lactation stages. The DPN concentration (micrograms per gram wet weight) remained relatively constant through gestation, average-204 (range, 156-266) and lactation, average-268 (range, 212-304).

The intracellular distribution of coenzyme A and DPN in lactating and non-lactating mammary gland tissue is similar, the highest concentration being found in the supernatant fraction.

Another study was conducted to obtain information on the biochemical composition of hormonally induced guinea pig mammary gland tissue. Comparing the succinoxidase QO₂ values from normal guinea pigs

(lactating, 21.2 ± 2.3 ; non-lactating, 2.8 ± 0.7) with values obtained in this experiment (lactating, 1.2 - 2.4; non-lactating, 2.1), it is evident that though the glands exhibited milk formation, the enzymatic activity was comparable to a normal preparturient gland. Coenzyme A values (16-34 Lipmann units) are also similar to those reported for pregnant animals. There was no variation in enzyme activity or coenzyme levels between the lactating and non-lactating states of the hormonally induced gland as has been reported in normal tissue. Injections of growth hormone and prolactin alone or in combination had no effect on raising succinoxidase activity or coenzyme A levels.

Since it was found in mammary gland tissue that coenzyme A fluctuated as the gland passed from gestation to lactation, these stages being under hormonal influence, a study was considered to test the effects of various hormones on coenzyme A in rat liver.

Hypophysectomy decreased the coenzyme A concentration in the liver of adult female rats. Thyroxine, cortisone acetate and growth hormone, as well as injections of calcium pantothenate, increased the coenzyme A level in the liver of the operated animals. Growth hormone appeared to be most effective in elevating the coenzyme concentration. When several combinations of the hormones were injected concurrently no synergistic effect was observed. In most instances the hormonal effects were additive in elevating the coenzyme A concentration, but the level was not restored to normal. In a number of experiments the DPN concentration was determined along with coenzyme A. DPN decreased 20 percent as compared to 57 percent decrease in the coenzyme A levels in the livers of hypophysectomized rats. Treatments with growth hormone and cortisone acetate returned the DPN concentration to normal, while thyroxine further depressed it.

68 pages. \$1.00. MicA 55-1294

THE BROWNING REACTION IN POTATO CHIPS

(Publication No. 11,918)

Robert Sands Shallenberger, Ph.D.
Cornell University, 1955

The studies discussed in this thesis were conducted to determine the constituents of potatoes responsible for development of color in potato chips. A model system technique was used in conjunction with potato tuber analyses to identify browning reactions which could occur at 188°C . (370°F .).

The concentrations of suspected color precursors for study were obtained by analysis of tubers that had received treatments in variety, harvest date, storage temperature, and prolonged storage at a given temperature. It was found that the storage temperature at which potatoes were held was the main factor influencing potato chip color. Nevertheless, the influence of potato variety, "maturity," and length of storage at a given temperature on potato chip color was also highly significant. Tubers which contained

the highest protein nitrogen content on date of harvest, and also varieties with highest protein nitrogen content tended to give lighter chips, especially after storage of tubers.

Following results of a model system "screening" study for possible color precursors, tubers were analyzed for percentage moisture, ascorbic acid, total, reducing, and non-reducing sugars, total nitrogen, protein nitrogen, non-protein, amide, amino, and basic nitrogen. Although reducing sugars correlated best with potato chip color, no one fraction generally paralleled potato chip color.

In an attempt to quantitatively account for chip color intensity by browning combinations of suspected color precursors for which analytical data were obtained, it was found that a browning reaction between total nitrogen of potatoes (i.e., protein and non-protein nitrogen) and total sugars (reducing and non-reducing) plus ascorbic acid most nearly approximated color intensities that developed in potato chips. The effect of ascorbic acid was slight, however.

Lastly, a scheme for the cumulative development of color in potato chips is presented based on interpretation of results with model systems studies, potato chips, and "reconstructed" synthetic browning systems. This scheme emphasizes the reactivity of the nitrogen compounds, and also the nitrogen-free components to be found in potato tubers required to quantitatively account for the major portion of pigment that may be developed when tubers from a number of treatments are processed into chips.

208 pages. \$2.60. MicA 55-1295

THE QUALITATIVE AND QUANTITATIVE DETERMINATION OF CERTAIN NITROGENOUS COMPOUNDS IN CHEDDAR CHEESE MADE FROM RAW AND PASTEURIZED MILK

(Publication No. 10,754)

Gerald Silverman, Ph.D.
Cornell University, 1955

Modern analytical techniques have been applied to the problem of the origin of typical and atypical cheese flavor with some measure of success but ambiguities have arisen concerning the concentrations of amino acids, particularly tyrosine and proline, amines, and the influence of pasteurization upon flavor intensity.

Experimental cheddar cheeses were made from either raw and pasteurized milk with a commercial lactic acid starter or with a mixture of this starter and DK (*Streptococcus faecalis*) starter. Commercially available raw and pasteurized milk cheeses were also obtained. All cheeses were analyzed for moisture, pH, fat, soluble protein, total protein, salt, and at periodic intervals for total and free tyrosine, tyramine, amines, and amino acids.

Free tyrosine was determined as tyramine after decarboxylation by an acetone preparation of *Streptococcus faecalis* by a new and rapid technique. The

tyramine extraction procedure involves multiple extraction by ether from an aqueous extract at pH 10.5. In addition to free tyramine, amines in cheese are also qualitatively measured.

For the experimental cheeses total tyrosine (free tyrosine and free tyramine) varied from a low of 69 to a high of 3583 γ /g. In the commercial cheeses free tyrosine ranged from 348 to 2630 γ /g and total tyrosine from 485 to 2921 γ /g.

Cheeses of similar soluble protein content did not always possess similar tyramine to tyrosine ratios. Whenever *S. faecalis* starter, or other organisms capable of decarboxylating tyrosine are present the tyramine concentration increased appreciably during ripening and in some cases even exceeded that of free tyrosine. It is apparent that free tyrosine is a measure of the difference between the rates of two reactions, (1) proteolysis, resulting in the liberation of free tyrosine and, (2) decarboxylation to tyramine. Any consideration of tyrosine as an estimate of proteolysis must also include tyramine.

Data is presented which shows that total tyrosine is being hydrolyzed at a uniform rate at the expense of the lower and intermediate peptides while that of protein solubilized decreases rapidly with age; that total tyrosine is a more sensitive measure of protein degradation than soluble protein.

Amine determination and paper chromatographic analysis provide evidence that the incidence of amino acid decarboxylase systems in cheese are more common than formally assumed. Two experimental cheddar cheeses made from raw milk developed an intense "unclean" flavor. Analysis showed the presence of large amounts of cadaverine, putrescine, and gamma aminobutyric acid which, in the other experimental cheeses, were absent or present in very small quantities. Raw milk experimental cheeses differed in general from pasteurized milk cheeses in having lower serine and higher aspartic acid concentrations.

Although commercial cheddar cheeses possessed either portions or the entire decarboxylating spectrum, the levels of cadaverine and putrescine were considerably greater in the raw milk cheeses, whereas the concentration of gamma aminobutyric acid varied. The serine-aspartic acid relationship were also the same as that experienced in the experimental cheeses, although there were individual exceptions.

Applying four criteria to commercial cheeses (1) amines, (2) gamma aminobutyric acid, (3) serine and (4) aspartic acid allowed one to obtain a more realistic picture of the type of fermentation occurring rather than the designation "raw" or "pasteurized." In general those cheeses containing significant amounts of gamma aminobutyric acid, amines, and lower serine and higher aspartic acid concentrations were more subject to criticism for being unclean in addition to having the highest intensity of typical cheddar cheese flavor.

A peptide, characterized by a very large proline content was found to be present in cheddar cheese.

76 pages. \$1.00. MicA 55-1296

THE CHEMICAL NATURE OF FATTY ACIDS OF MICROBIOLOGICAL ORIGIN

(Publication No. 11,610)

Fred Tausig, Ph.D.
University of Pittsburgh, 1955

1. The fatty acid spectrum of a group C *Streptococcus* species, Strain H 46 A, has been qualitatively evaluated. The lipide content of the dry cells was 4.5 per cent. The major portion of these lipides was present in a "bound" form and only a minor fraction was acetone extractable ("free" lipides). The "bound" lipides were composed of small quantities of lauric and myristic acids and large amounts of C₁₆ and C₁₈ acids. The C₁₆ fatty acid fraction contained palmitic, 9,10-hexadecenoic (palmitoleic) and a small amount of 11,12-hexadecenoic ("palmitvaccenic") acids. In addition to stearic acid the C₁₈ fraction contained a large proportion of *cis*-vaccenic acid and small amounts of oleic acid. A careful investigation of the highest boiling ester fraction derived from the "bound" lipides failed to reveal the presence of lactobacillic acid. The composition of the "free" lipides was similar to that of the "bound" lipides.

2. The fatty acids from the "bound" lipides of the fresh water algae *Chlorella pyrenoidosa* were screened for branched-chain components. No branched-chain fatty acids were detected. Oleic acid was found to be the major monoethenoid octadecanoic acid component.

3. A reinvestigation of the chemical nature of the fatty acids of the plant pathogen *Agrobacterium* (*Phytomonas*) *tumefaciens* has led to results which differ significantly from those of previous workers. The lipides of this organism (7.5 per cent of dry weight of cells) were found to contain palmitic acid (10 per cent), *cis*-vaccenic acid (69 per cent), lactobacillic acid (13 per cent) and unidentified high-boiling materials (8 per cent). No stearic acid could be detected. The liquid saturated fatty acid component previously called "phytomonic acid" was shown to be lactobacillic acid.

4. A simple method for the isolation of dihydrosterculic acid from the kernel oil of the tropical tree *Sterculia foetida* was developed. Comparison of the infrared absorption spectra and the microbiological activities of dihydrosterculic acid and lactobacillic acid suggests the *cis* configuration for the latter compound.

5. A new method for the fractional low temperature crystallization of small quantities of low-melting substances was developed. The procedure was applied successfully for the isolation and purification of 50 mg. of lactobacillic acid from the mixed fatty acids of *A. tumefaciens* as well as for the purification of various monoethenoid hexadecenoic and octadecanoic acid fractions.

144 pages. \$1.80. MicA 55-1297

CHEMISTRY, INORGANIC

STUDIES ON THE SYNTHESIS OF
CHLORAMINE AND HYDRAZINE

(Publication No. 12,020)

Russell Stephen Drago, Ph.D.
The Ohio State University, 1954

Adviser: Harry H. Sisler

A study has been made of the following topics: (1) the synthesis of chloramine by the gas phase reaction of ammonia and chlorine; (2) the role of caustic, gelatin and ammonium ion in the reaction of chloramine with ammonia in aqueous solution; (3) the effect of fixed base and gelatin on the reaction of chloramine with ammonia in liquid ammonia and in ethyl alcohol; (4) the separation of anhydrous hydrazine from mixtures of ammonium chloride, ammonia and hydrazine; and (5) the composition and pressure of the vapor in equilibrium with liquid mixtures of hydrazine and ammonia at 88.5, 100.3, 114.1 and 124.9°C.

It has been shown that high yields of chloramine may be obtained from the gas phase reaction of ammonia with chlorine using much lower ratios of ammonia to chlorine than had previously been considered possible, and without diluting the chlorine stream with an inert gas. It was demonstrated further that the rate of flow of the gas mixture away from the reaction zone is a critical factor in determining the yield of chloramine. High yields of chloramine were obtained in our reactor without too much dependence upon the ammonia to chlorine mole ratio so long as a total rate of gas flow greater than about eight moles per hour was employed. In all these experiments a considerable excess of ammonia over the stoichiometric requirements was present.

Quantitative study of the effect of caustic on the reaction of chloramine with aqueous ammonia to produce hydrazine has shown that caustic serves only two purposes in this reaction: (a) to neutralize ammonium ion formed in the reaction which has been shown to affect the yield of hydrazine adversely; (b) to stabilize the gelatin-metal ion complex, the formation of which prevents the metal ion catalysis of the reaction of chloramine with hydrazine. The gelatin is ineffective as an inhibitor when fixed base is not present to stabilize the complex.

Excess alkali over that required for (a) and (b) is deleterious to the process.

The addition of gelatin and potassium amide to liquid ammonia solution, as well as gelatin and potassium alcoholate addition to ethyl alcohol solutions saturated with ammonia, was shown to have no effect upon the yield of hydrazine from the chloramine-ammonia reaction in these solvents.

It has also been shown that hydrazine can be separated from the reaction product of the chloramine-ammonia reaction by a high temperature-high pressure distillation. Very serious decomposition of hydrazine occurred in the stainless steel autoclave at elevated temperatures. However, this decomposition

problem was overcome by coating the apparatus with Teflon enamel.

The composition and pressure of the vapor in equilibrium with liquid mixtures of hydrazine and ammonia were determined at 88.5, 100.3, 114.1 and 124.9°C. Activities were calculated for the components and compared with the values calculated from the Gibbs-Duhem equation.

131 pages. \$1.64. MicA 55-1298

INSTRUMENTAL INVESTIGATIONS OF
COMPLEX ION EQUILIBRIA

(Publication No. 12,178)

John Grove Mason, Ph.D.
The Ohio State University, 1955

The complexes of mercury (II) ion with ethylenediamine and ethylenediaminetetraacetic acid were investigated both polarographically and potentiometrically. The final determination of the equilibrium constants was made from potentiometric measurements by use of the dropping mercury electrode as the indicator electrode for the concentration of mercury (II) ions.

The mixed complexes formed between copper (II) ion, ammonia, and bidentate anions were investigated spectrophotometrically. The bidentate anions used were oxalate ion and pyrophosphate ion. The extinction data for the copper (II) ion, ammonia, and pyrophosphate ion system was evaluated by use of the slope-intercept method. The extinction data for the copper (II) ion, ammonia, and oxalate ion system was evaluated by the slope-intercept technique, the method of Lewis, an application of the equation of Leden, and independently by the titration method of Bjerrum. The comparison of the spectrophotometric evaluations led to the conclusion that the most reliable method was the slope-intercept method.

The complexity constant for



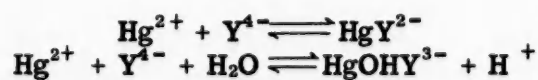
is $K_T = 10^{22.57}$ at 25°C, 0.1 M KNO_3 .

The equilibrium constant for



is $k_1 = 10^{14.65 \pm .20}$ at 25°C, 0.1 M KNO_3 .

For



the constants are respectively $K_{\text{HgY}} = 10^{21.15}$ and $K_{\text{HgOHY}} = 10^{12.30}$ at 25°C, mean ionic strength 0.30.

The copper complexes, $[\text{Cu}(\text{NH}_3)_2(\text{P}_2\text{O}_7)]^{2-}$ and $[\text{Cu}(\text{NH}_3)_2(\text{C}_2\text{O}_4)]^0$ were identified as being the predominant complexes formed in the two systems considered.

For $\text{Cu}^{2+} + 2\text{NH}_3 + \text{P}_2\text{O}_7^{4-} \rightleftharpoons [\text{Cu}(\text{NH}_3)_2\text{P}_2\text{O}_7]^{2-}$ the equilibrium constant is $10^{14.22}$.

For $\text{Cu}^{2+} + 2\text{NH}_3 + \text{C}_2\text{O}_4^{4-} \rightleftharpoons [\text{Cu}(\text{NH}_3)_2\text{C}_2\text{O}_4]^0$ the equilibrium constant is $10^{12.80}$.

92 pages. \$1.15. MicA 55-1299

A STUDY OF THE PREPARATION
AND PROPERTIES OF ALKOXY SUBSTITUTED
BOROHYDRIDES

(Publication No. 11,648)

Edward J. Mead, Ph.D.
Purdue University, 1955

Major Professor: Herbert C. Brown

The trimethoxyborohydrides and triethoxyborohydrides of sodium and lithium were prepared in refluxing tetrahydrofuran by the reaction of the alkali metal hydrides with the borate ester according to the following equation: $MH + B(OR)_3 \rightarrow MHB(OR)_3$.

These compounds were found to disproportionate rapidly to give a mixture of alkoxy substituted borohydrides. The fact that this disproportionation is reversible in the sodium system was demonstrated by preparing solutions, starting with sodium borohydride and the appropriate sodium tetraalkoxyborohydride, which were identical to those obtained from sodium hydride and the borate ester.

Sodium triisopropoxyborohydride resulted from a slow reaction of sodium hydride with isopropyl borate in refluxing tetrahydrofuran. The product, sodium triisopropoxyborohydride, was isolated, characterized, and found to be a powerful reducing agent. For example, it reduces acetone much more rapidly than does sodium borohydride. Lithium triisopropoxyborohydride was prepared in solution by means of the analogous reaction between lithium hydride and isopropyl borate; however, due to less favorable solubility characteristics, this compound did not receive further study.

Progress was made in attempting to correlate the structure of various borohydrides with their reducing properties. An investigation of the reactions of trialkoxyborohydrides with acid chlorides has resulted in procedures giving yields of benzaldehyde up to 47% using sodium trimethoxyborohydride. Evidence is presented to the effect that the low yields are due to a concurrent reduction of the aldehyde to the alcohol.

Isopropyl alcohol and the dimethyl ether of triethylene glycol are proposed as new and convenient solvents for sodium borohydride. The rates of reduction of acetone, methyl ethyl ketone, methyl isopropyl ketone, and pinacolone by sodium borohydride were determined in isopropyl alcohol, and were found to follow a simple second order rate law. This rate expression is consistent with a step-wise reduction of the ketone in which the first step is rate determining. The rate constants which were obtained follow the order which would be predicted on the basis of the steric requirements of the ketone; e.g., acetone was fast and pinacolone was slow.

The trans-esterification of methyl borate with the alcohol of the desired borate is proposed as a convenient and general method of preparing alkyl borate esters. Ethyl, isopropyl, and tertiary butyl borates were prepared in good yields by this reaction.

The methoxide, ethoxide and isopropoxide of sodium reacted with methyl, ethyl, and isopropyl borates respectively to form the corresponding

tetraalkoxyborohydrides. The analogous reaction between sodium tertiary butoxide and tertiary butyl borate did not occur under similar conditions. In addition it was demonstrated that there is little or no reaction between sodium tertiary butoxide and tertiary butyl borate. The tetraalkoxyborohydrides were shown to be thermally stable up to temperatures of about 240°C. Tetrahydrofuran and the corresponding alcohol ranged from excellent to fair as solvents for these compounds. 231 pages. \$2.89. MicA 55-1300

THE EXTRACTION OF IRON, COBALT,
AND NICKEL SULFATES

(Publication No. 12,189)

Carl Solomon Schlea, Ph.D.
The Ohio State University, 1955

The separation of iron, cobalt, and nickel has long been of commercial and academic importance. In recent years, interest has been shown in the use of liquid-liquid extraction to separate components of mixtures of inorganic compounds. Some cobalt and nickel recovery processes involve the use of sulfuric acid solutions of the metals. This investigation was carried out to thoroughly study the use of liquid-liquid extraction as a method of separating iron, cobalt, and nickel sulfates from aqueous solutions.

The first series of tests was made to determine distribution data for the pure metal sulfates between water and a large number of organic solvents at 25.0°C. when each metal was equilibrated separately. The effects of sulfuric acid, sodium sulfate, and ammonium sulfate on the distribution characteristics were determined for each metal. Distribution runs were then carried out with the best solvent.

The alkyl acid phosphates were found to be the best series of compounds for extraction purposes. Supplementary experimental work showed that a chemical reaction took place and the sulfate ion was not extracted. These compounds were thus eliminated as possible extraction media. Most non-acidic organic compounds did not extract iron, cobalt, and nickel sulfates to any measurable degree. Of these non-acidic organic solvents, the lower alcohols were found to be the best series of compounds to extract the metal sulfates. Sulfuric acid increased distribution coefficients markedly, while sodium sulfate and ammonium sulfate had detrimental effects on extraction.

Electrostatic considerations of ions in solution could not explain the extraction. Solvents with high dielectric constants extracted less than some with considerably lower dielectric constants. Also, extraction could not be correlated with the degree of water solubility in the organic phase. Although no quantitative information concerning the strength of hydrogen bonds is available, the relative order of magnitude of distribution coefficients changed in much the same manner as relative strengths of hydrogen bonding characteristics of the organic solvents.

Normal butyl alcohol was chosen in conjunction with sulfuric acid to determine extraction characteristics with iron, cobalt, and nickel sulfates. Distribution coefficients, when each metal was equilibrated separately, were on the order of magnitude of 0.0001 at 25.0°C. With the addition of up to 250 grams of sulfuric acid per liter of the water phase, these distribution coefficients increased over 100 times, values over 0.01 being obtained. Separation factors were low, and varied with acid and metal concentrations. Maximum cobalt-to-nickel separation factors were about 1.4. Maximum iron-to-nickel and iron-to-cobalt separation factors were about two. Separation factors varied only slightly with increased sulfuric acid concentrations when metal concentrations were high but increased when metal concentrations were low. Distribution coefficients could be doubled by increasing the temperature from 25.0°C. to about 70°C. Distribution coefficients, when the metals were equilibrated together, were 50 to 80 per cent lower than when each metal was equilibrated alone.

It was concluded from the experimental work that the separation of iron, cobalt, and nickel sulfates by liquid-liquid extraction is not commercially feasible. This conclusion was reached on the basis of the distribution of these metal sulfates between water and a wide variety of organic solvents. Distributions in favor of the organic phase were very low. Solvents which extracted one of the metals also extracted the others. Small separations could be obtained, but such large volumes of solvent would be required that the cost of such an operation would be prohibitive. The addition of sulfuric acid increased extraction, but, again, such large amounts would be required that the cost of the additive would again prohibit commercial use of such a system.

159 pages. \$1.99. MicA 55-1301

CHEMISTRY, ORGANIC

PERFLUOROALKYL ZINC COMPOUNDS

(Publication No. 12,276)

Elliot Bergman, Ph.D.
Cornell University, 1955

Perfluoroalkyl mercuricals were the first stable perfluoroorganometallic reagents prepared. However, no reactions of synthetic importance were reported for this class of compounds. More recently, the relatively unstable perfluoroalkyl magnesium and lithium compounds were prepared. However, due to the intrinsic difficulties involved in their preparation and handling, their utility has been somewhat limited.

In sharp contrast to the perfluoroalkyl magnesium and lithium compounds the first perfluoroalkyl zinc compound, heptafluoro-n-propyl zinc iodide, was found to be easily preparable at convenient

temperatures, and was stable in solution at slightly elevated temperatures. It was the purpose of the present investigation to study the preparation, properties and synthetic usefulness of perfluoroalkyl zinc compounds. Convenient methods of preparing a number of stable perfluoroalkyl zinc compounds were developed. Perfluoro-n-propyl iodide was readily converted into perfluoro-n-propyl zinc iodide, in dioxane, or ethylene glycol dimethyl ether in yields of up to 77%. Heptafluoropropane was formed as a by-product in approximately 10% yield. Perfluoro-n-propyl zinc iodide reacted with pyridine to yield the solid perfluoro-n-propyl zinc iodide pyridine complex. Distillation of dioxane solutions of perfluoro-n-propyl zinc iodide yielded perfluoropropene and traces of perfluorodi-n-propyl zinc dioxanate. Distillation of ethylene glycol dimethyl ether solutions of perfluoro-n-propyl zinc iodide yielded the ethylene glycol dimethyl etherate of perfluorodi-n-propyl zinc in yields of up to 50%, in addition to perfluoropropene. The etherate was converted into perfluorodi-n-propyl zinc dipyridinate in 94% yield on treatment with pyridine.

Perfluoro-n-propyl bromide was converted into perfluoro-n-propyl zinc bromide, the first example of a perfluoroalkyl zinc bromide. Attempted preparations of the corresponding zinc compounds from trifluoriodomethane, bromodichlorofluoromethane, dichlorofluoriodomethane, 1,2-dichloro-1-iodotrifluoroethane and perfluoroallyl iodide failed.

The mechanism of the coupling of perfluoroalkyl iodides and bromides by reaction with metallic zinc was studied. Conditions were developed for converting perfluoro-n-propyl iodide into predominantly perfluoro-n-hexane or perfluoro-n-propyl zinc iodide, as desired.

It was found that perfluoroalkyl zinc compounds reacted with electrophilic organic reagents at a much slower rate than alkyl zinc compounds. Due to their slow rate of reaction only low yields of the expected addition products were obtained in a variety of reactions. Principal reactions involving the solvent, zinc salts, and a reactant which produced active hydrogen converted the perfluoroalkyl zinc compounds to corresponding hydro derivatives, R^*H . When reactants were employed which did not react at a competing rate with the solvent or furnished active hydrogen moderate to good yields of the expected products were obtained. Such reactants were: water, halogen, benzaldehyde and phthalic anhydride. On the basis of these observations solvated perfluoroalkyl zinc compounds were indicated to be useful synthetic reagents in reactions with molecules which do not enolize in the presence of zinc salts, and which do not react with the solvent to produce active hydrogen.

198 pages. \$2.48. MicA 55-1302

I. THE POLAROGRAPHIC BEHAVIOR OF
ORGANIC COMPOUNDS IN ANHYDROUS
METHANESULFONIC ACID.

II. THE POLAROGRAPHIC BEHAVIOR OF
ORGANIC COMPOUNDS IN
ANHYDROUS DIMETHYLFORMAMIDE.

(Publication No. 12,099)

Reynold Andrew Berkey, Ph.D.
State University of Iowa, 1955

Chairman: Professor Stanley Wawzonek

Part I.

This work which was undertaken to determine the suitability of methanesulfonic acid as a solvent for the polarographic study of organic compounds was carried out with triarylcarbinols, aromatic nitro compounds, ketones, and aldehydes.

Triarylcarbinols gave reduction waves which corresponded to the reduction of the carbonium ion to the triarylmethane. The addition of water to the solution caused this wave to split into two waves, with a total height approximately equal to that of the wave in anhydrous media. The first of these waves corresponded to the reduction of the carbonium ion to the free radical, and the second wave indicated the reduction of the free radical to the methane.

Nitrobenzene and p-nitrotoluene each gave a wave that was proportional to the concentration at concentrations below 0.5 millimolar. This wave corresponded to a four-electron reduction to the phenylhydroxylamine. Evidence for this mechanism was the formation of p-aminophenol from the large scale reduction of nitrobenzene.

Aromatic ketones and p-tolualdehyde gave waves which were not diffusion waves, and which appeared at concentrations above 5.0 millimolar. The waves for the ketones were partially kinetically controlled, whereas that for p-tolualdehyde had the properties of an adsorption wave. p-Chlorobenzaldehyde gave a wave which appeared only in the presence of water, and had the characteristics of a diffusion controlled wave. Benzaldehyde gave no reduction wave; however, large scale reduction of this compound yielded desoxybenzoin. Thus benzaldehyde must be reduced at a potential coincident with the reduction of the acid.

Part II.

Dimethylformamide and acetonitrile have been used as solvents for polarographic studies of aromatic olefins, quinones, and alkyl halides.

Stilbene and 9-anisylidenefluorene have been found to reduce polarographically stepwise in anhydrous dimethylformamide, whereas styrene and tetraphenylethylene gave only one wave. The first of the two waves corresponds to the reduction of the olefin to the anion-free radical, while the second corresponds to the reduction of the anion-free radical to the dianion. The dianion then reacts with the dimethylformamide, abstracting two protons to form

the saturated hydrocarbon. The presence of vinyl acetate effects the heights of the waves for stilbene and suggests a reaction of the intermediate anion-free radical with vinyl acetate. This behavior was confirmed by a large scale electrolysis of a mixture of polymeric materials was obtained.

Quinones are reduced stepwise to the semiquinone anion and hydroquinone dianion in anhydrous dimethylformamide. The addition of benzoic acid to the quinone solution causes the two waves to merge into one and gives a similar behavior to that found in water. 2-Methyl-1,4-naphthohydroquinone was not oxidized polarographically in either anhydrous dimethylformamide or acetonitrile. Addition of water to these solutions brought out one oxidation wave.

Benzophenone yielded two reduction waves in dimethylformamide which correspond to the reduction to the ketyl and benzhydrol dianion. Ethyl bromide and ethyl iodide each gave one two-electron reduction wave in anhydrous acetonitrile.

148 pages. \$1.85. MicA 55-1303

SYNTHESIS AND PROPERTIES OF
SOME ARALKYL HYDROPEROXIDES

(Publication No. 12,007)

Arlo Dye Boggs, Ph.D.
The Ohio State University, 1954

Adviser: Cecil E. Boord

Organic hydroperoxides have been postulated as intermediates in the oxidation of hydrocarbons, fatty acids and other organic compounds. Such oxidation takes place at a relatively slow rate under normal conditions of storage, but there is an accelerated rate in an internal combustion engine or when some suitable compound is subjected to the action of oxygen at an elevated temperature.

Such compounds as ethylbenzene and toluene display unusual reactivity toward oxidation and in addition are very good fuels when burned in an internal combustion engine. These contain active hydrogen atoms of the benzylic type.

A free radical mechanism has been tentatively employed to explain the circumstances of formation of hydroperoxides and their mode of decomposition in the oxidizing situation. In order to study the properties of pure hydroperoxides, the ways in which they decompose and the effect their decomposition has on a surrounding medium, samples of pure hydroperoxides are necessary.

In this work it has been found that primary and secondary aralkyl alcohols as a class generally were reactive in the presence of dilute hydrogen peroxide and dilute acid. These alcohols formed hydroperoxide concentrates of varying purity depending on the structure of the alcohol and the experimental conditions.

It has also been found that olefins in which the double bond is conjugated with a benzene ring were converted to hydroperoxides with dilute acid and

dilute hydrogen peroxide. As a rule the olefin gave the same hydroperoxide as the corresponding phenyl carbinol. 147 pages. \$1.84. MicA 55-1304

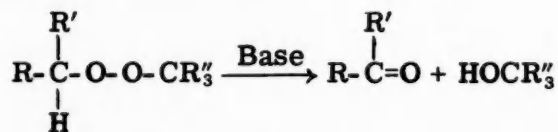
**PART I: THE BASE CATALYZED
DECOMPOSITION OF PEROXIDES.
PART II: KINETICS OF THE BASE
CATALYZED DECOMPOSITION OF PEROXIDES.**

(Publication No. 11,620)

Sheldon Lewis Clark, Ph.D.
Purdue University, 1955

Major Professor: Nathan Kornblum

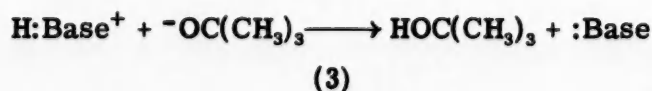
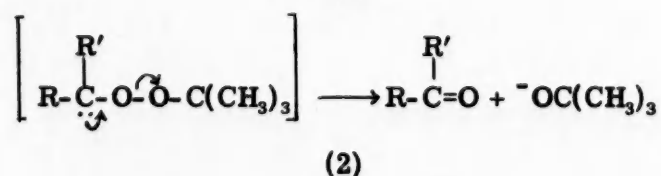
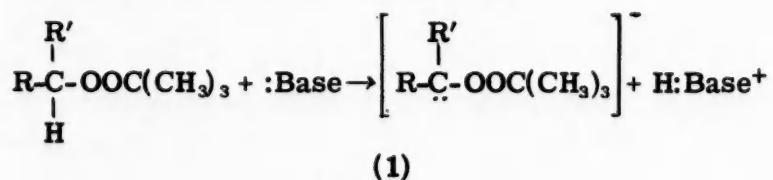
Dialkyl peroxides and alkyl hydroperoxides having a hydrogen atom on the carbon attached to the peroxide linkage undergo base catalysed decomposition at room temperature, e.g.,



Peroxides such as 1-phenylethyl-t-butyl peroxide, benzyl-t-butyl peroxide and isopropyl-t-butyl peroxide undergo the decomposition while di-t-butyl peroxide, cumene peroxide, p-cymene peroxide, isopropyl naphthalene hydroperoxide, phenylcyclohexane hydroperoxide and p-cymene hydroperoxide are stable to bases under the conditions studied. Isobutyl-t-butyl peroxide appears to be anomalous; no decomposition could be detected with as strong a base as ethanolic potassium hydroxide.

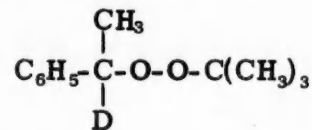
Such bases as sodium ethoxide, sodium methoxide, ethanolic potassium hydroxide, trimethyl amine and piperidine are capable of effecting decomposition. Pyridine is too weak a base to cause reaction at a perceptible rate.

The foregoing facts, and a number of others which are discussed in detail, find a simple explanation in the following sequence in which it should be noted steps 1 and 2 occur simultaneously:



On this basis rupture of the carbon-hydrogen bond is occurring in the rate-controlling step. As a test

of this hypothesis the deuterated peroxide was synthesized and the kinetics of its decomposition under the



influence of piperidine in t-butanol solution was compared with that of the undeuterated peroxide. The deuterium free peroxide decomposes six times faster than the deuterated peroxide; this isotope effect is consistent with the proposed mechanism.

The kinetics of the reaction of piperidine with these two peroxides and with benzyl-t-butyl peroxide were measured. Benzyl-t-butyl peroxide was found to have the lowest energy of activation (14 kilocal./mole) while the energies of activation for the other two peroxides were found to be identical within the experimental error (15.6-15.8 kilocal./mole). Because the concentration of the base remained constant, the rates were found to follow pseudo-first order kinetics. 290 pages. \$3.63. MicA 55-1305

**SYNTHESES AND PROPERTIES
OF SOME SIMPLE POLYMETHINES**

(Publication No. 12,129)

George Feniak, Ph.D.
University of Washington, 1955

In the course of a study of some polymethines, a number of new reactions involving polymethines and some related compounds have been investigated. New synthetic routes to the penta- and heptamethines have been devised. Since the products obtained by the different routes were identical, this work not only serves to establish the structures of these compounds but also indicates that *cis* and *trans* isomers of polymethines are readily interconvertible. It has been shown that the vinylogous carboxylate and the vinylogous amidinium compounds can be interconverted.

During this work the reaction paths followed by a number of unorthodox Reformatsky reactions were investigated. The Reformatsky reaction of 1,3,3-trimethoxypropene-1 and methyl bromoacetate gives methyl 3,5-dimethoxy-4-pentenoate. That between ethyl orthoformate and ethyl γ -bromocrotonate gave a mixture of the diethyl acetal of ethyl γ -formylcrotonate and the diethyl acetal of 2-carboethoxy-3-butenal. The Reformatsky reaction of methyl γ -bromocrotonate with 1,3,3-trimethoxypropene-1 and 5-methoxy-2,4-pentadienal gave the γ -condensation products, 1,3-dimethoxy-4-carbomethoxy-1,5-hexadiene and 5-hydroxy-1-methoxy-6-carbomethoxy-1,3,7-octatriene respectively.

The alcohols formed by Reformatsky reactions on 5-methoxy-2,4-pentadienal, when treated with acid, do not dehydrate but undergo an abnormal elimination giving 6-substituted sorbaldehydes. This elimination can be explained by an anionotropic rearrangement of the hydroxyl group to the terminal position

giving a hemiacetal. The latter would readily go over to the aldehyde.

Consideration of polymethines in terms of resonance theory would lead one to expect that they are resonance stabilized. This is supported by the values of the ionization constants of polymethines and their conjugate acids; they indicate that the symmetrical systems are the most stable. Since 1,5-bis-(dimethylamino)pentamethinium perchlorate undergoes substitution reactions, this resonance stabilization must be quite appreciable.

1,5-bis-(Dimethylamino)pentamethinium perchlorate undergoes monobromination, monochlorination, mono- and dinitration. Cyclization of the monosubstituted derivatives to the corresponding 3-substituted pyridines showed that substitution had occurred at the 2-position of the polymethine chain. Attempted acylation, alkylation and nitrosation of 1,5-bis-(dimethylamino)pentamethinium perchlorate were completely unsuccessful. The reaction with diazonium salts, and mercuric chloride gave products whose structures were not established.

In contrast to its aromatic-like behavior during some substitution reactions, 1,5-bis-(dimethylamino)pentamethinium perchlorate reacts readily with the double bond reagents, potassium permanganate and osmium tetroxide.

Although it is unreasonable to compare 1,5-bis-(dimethylamino)-pentamethinium perchlorate (and other polymethines) with some of the classical aromatic compounds such as benzene and pyridine, it is not so unreasonable to compare it with some of the less stable heterocyclic compounds such as furan and pyrrole.

192 pages. \$2.40. MicA 55-1306

THE CHEMISTRY OF SULTONES. I. FRIEDEL-CRAFTS ALKYLATIONS BY SULTONES. II. ALKYLATIONS OF ORGANOMETALLIC AND RELATED COMPOUNDS BY SULTONES.

(Publication No. 11,632)

Fred Donald Hoerger, Ph.D.
Purdue University, 1955

Major Professor: Dr. William E. Truce

Part I

There have been several recent reports of the reactions of lactones with aromatic hydrocarbons in the presence of aluminum chloride to form ω -arylalkanoic acids in good yields. (1,2,3,) The purpose of this problem was to investigate the possibility of utilizing sultones, sulfonic acid analogs of lactones, as Friedel-Crafts alkylating agents for the synthesis of ω -arylalkanesulfonic acids.

4-Hydroxy-1-butanefulfonic acid sultone was synthesized by dehydration of the corresponding hydroxysulfonic acid. Dehydration of 5-hydroxy-1-pentanesulfonic acid, however, gave 4-hydroxy-1-pentanesulfonic acid sultone. Available evidence indicated that five-membered ring sultones are more

reactive and less stable than similarly constituted six-membered ring sultones. An explanation for this inversed order of reactivity as compared to lactones is presented. The conclusion is developed that sultones are stabilized by increased substitution.

By utilizing an excess of the aromatic compound as solvent and a molar ratio of aluminum chloride to sultone of 1.1, good yields (54-88%) of 4-aryl-1-alkanesulfonic acids, isolated as their sodium salts, were obtained. The Friedel-Crafts reactions of 4-hydroxy-1-butanefulfonic acid sultone with benzene, *p*-xylene, and *p*-dichlorobenzene and of 4-hydroxy-1-pentanesulfonic acid sultone with benzene gave sodium 4-phenyl-1-butanefulfonate, sodium 4-(2,5-dimethylphenyl)-1-butanefulfonate, sodium 4-(2,5-dichlorophenyl)-1-butanefulfonate, and sodium 4-phenyl-1-pentanesulfonate, respectively. Ferric chloride, but not stannic chloride, could be satisfactorily substituted for aluminum chloride as the catalyst. The structures of the above alkylation products were established by independent syntheses. Significantly, no rearrangement of the carbon skeleton of the entering side chain occurred during the alkylations. This indicates that the classical carbonium ion mechanism for Friedel-Crafts alkylations is not operative in these cases and suggests that a nucleophilic displacement mechanism occurs. Sulfonates were obtained readily from the reactions of 4-hydroxy-1-butanefulfonic acid sultone with toluene, chlorobenzene, and anisole, but the products were mixtures of substitution isomers. Only a poor yield of sulfonate was obtained from the reaction of 4-hydroxy-1-butanefulfonic acid sultone with dodecylbenzene.

2-*o*-Hydroxyphenylethanesulfonic acid sultone, synthesized by the cyclization of sodium 2-*o*-hydroxyphenylethanesulfonate with phosphorous oxychloride, was inert in the Friedel-Crafts reaction.

Part II

Helberger (4) and co-workers have shown that sultones serve as alkylating agents for a variety of nucleophilic reagents. The products of these alkylation reactions are substituted alkanesulfonates, but their structures were not established. In order to definitely establish the nature of the products obtained from the reactions of sultones with nucleophilic reagents, the reactions of sodium ethoxide and sodium benzenesulfinate with 4-hydroxy-1-butanefulfonic acid sultone were studied. The products of these reactions were sodium 4-ethoxy-1-butanefulfonate (91% yield) and sodium 4-phenylsulfonyl-1-butanefulfonate (53% yield), respectively. The structures were established by independent syntheses. These reactions show that there is a similarity in the reactions of sultones and alkyl sulfonates with nucleophilic reagents. Since alkyl sulfonates serve as carbon-carbon alkylating agents of organometallic compounds, it seemed probable that sultones could serve as carbon-carbon alkylating agents of organometallic and related compounds.

Carbon-carbon alkylation readily occurred in the reactions of 4-hydroxy-1-butanefulfonic acid sultone with phenylethynylsodium, *n*-butyllithium, and the sodium derivatives of diethyl malonate, ethyl

acetoacetate, and dibenzoylmethane to give sodium 6-phenyl-5-hexyne-1-sulfonate, lithium 1-octane-sulfonate, sodium 5,5-dicarbethoxy-1-pentanesulfonate, sodium 5-carbethoxy-6-oxo-1-heptanesulfonate, and sodium 5,5-dibenzoyl-1-pentanesulfonate, respectively (50-95% yields). The structures of these products were determined by independent syntheses or by degradative procedures. The reaction of 4-hydroxy-1-butanefulfonic acid sultone with phenylmagnesium bromide produced both magnesium 4-phenyl-1-butanefulfonate and magnesium 4-bromo-1-butanefulfonate. The reaction of 2-o-hydroxyphenylethanesulfonic acid sultone with phenylmagnesium bromide gave *o*-(β -phenylsulfonyl)ethyl-phenol.

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206 pages. \$2.58. MicA 55-1307

A STUDY OF THE FRIEDEL-CRAFTS REACTION: EVIDENCE FOR A CONCERTED DISPLACEMENT MECHANISM IN PRIMARY ALKYLATION OF AROMATIC COMPOUNDS

(Publication No. 11,634)

Hans Jungk, Ph.D.
Purdue University, 1955

Major Professor: Herbert C. Brown

The alkylation of benzene and toluene has been investigated using various alkyl halides and aluminum bromide, in order to determine the mechanism of alkylation of aromatics with aliphatic halides. In conjunction, the isomerizations of several dialkylbenzenes were also investigated.

Isomerization of *p*- and *o*-xylenes resulted in exclusive *m*-xylene formation. In the isomerization of *o*-xylene, no *p*-xylene was detected. No *o*-xylene was found in the isomerization of *p*-xylene. The rates were first order in xylene and first order in aluminum bromide-hydrogen bromide. The resultant second order rate constants are: for *o*-xylene, 5.84×10^{-6} and 1.98×10^{-4} l. mole⁻¹ sec.⁻¹ at 0° and 25°, respectively; for *p*-xylene, 3.25×10^{-5} and 8.78×10^{-4} l. mole⁻¹ sec.⁻¹ at these temperatures. Qualitative investigation of the isomerization of *p*-ethyl- and *p*-isopropyltoluenes indicated that the relative isomerization tendencies are: isopropyl > ethyl > methyl. Also, the ease of intermolecular alkyl group transfer (disproportionation) results in the order: *t*-butyl > isopropyl > ethyl > methyl. The results are explained by postulating a high energy, localized pi complex intermediate as controlling the rate of both processes.

The reactions of benzene and toluene with methyl bromide in the presence of molar quantities of aluminum bromide are extremely rapid. In the homogeneous system produced by reacting 6 moles of aromatic, 1 mole of aluminum bromide (Al₂Br₆) and 1 mole of methyl bromide, the reaction with toluene was complete in 30 sec. or less at 0°. Methyl iodide has been found to react 200 times more slowly under the same conditions. This has been attributed to weaker complex formation between iodine and aluminum bromide resulting in a decrease in electrophilic assistance. This decrease can be attributed to the difference in the basic strength of the I⁻ and Br⁻ or to steric factors. Less than 7% polymethylated products are obtained under these conditions due presumably to the formation of stable sigma complexes between the products, catalyst and hydrogen bromide.

Competitive methylation of benzene and toluene using methyl bromide and aluminum bromide results in the following relative reactivity values: at 0°, 3.8; at 25°, 3.0; at 45°, 2.5; with methyl iodide and aluminum bromide at 0°, the relative reactivity is 4.8. The isomer distributions obtained from methylation of toluene with the same halide-catalyst combinations are: methyl bromide-aluminum bromide at 0°, 52.9% *o*-, 17.5% *m*- and 29.6% *p*-xylene; at 25°, 49.8% *o*-, 20.9% *m*- and 29.3% *p*-xylene; methyl iodide and aluminum bromide at 0°, 47.6% *o*-, 12.9% *m*- and 39.5% *p*-xylene. The differences between the relative reactivities and isomer distributions thus obtained rule out an ionic mechanism for the methylation of aromatics under these conditions. The data suggest that the reaction involves a nucleophilic attack by the aromatic on the polarized methyl halide-aluminum bromide addition compound leading to a displacement of the halide-catalyst group.

The reactions of ethyl-, isopropyl- and *t*-butyl bromides with benzene and toluene under the influence of aluminum bromide are extremely fast. The reactions are essentially complete in 0.005 sec. or less. The relative reactivity of toluene and benzene at 25° with these alkyl bromides is, ethylation, 2.40; isopropylation, 1.65. These data, plus data on isomer distributions resulting from ethylation, isopropylation and *t*-butylation of toluene, result in a sequence which suggests that the alkylation mechanism changes in this series of alkyl halides. Methylation and ethylation are believed to proceed by a displacement mechanism and isopropylation and *t*-butylation by an ionic process. The kinetics of the reaction of methyl- and ethyl bromides with benzene and toluene in 1,2,4-trichlorobenzene are third order; first order in aromatic, aluminum bromide and alkyl bromide. Isopropyl bromide reacted extremely fast under these conditions. The order of rates is: methylation 1, ethylation 57, isopropylation, >2500. The relative reactivities of toluene and benzene found kinetically are methylation, 5.10 and ethylation 2.89. The kinetics support the proposal that the reactions of ethyl- and methyl bromides involve a nucleophilic displacement reaction. The order of rates: methyl < ethyl < isopropyl, can be accounted for by assuming an increase in the bond breaking in the alkyl halide-aluminum bromide addition compound with the ability of the alkyl group to stabilize the resulting positive charge. The

bond breaking is believed to be complete at isopropylation so that this reaction precedes by an ionic mechanism. This is a limiting case. No further decrease in the assistance by the nucleophilic agent is believed to occur in going to *t*-butylation.

261 pages. \$3.26. MicA 55-1308

THE MERCURATION OF AROMATICS.
A QUANTITATIVE TREATMENT
OF AROMATIC SUBSTITUTION.

(Publication No. 11,647)

Charles W. McGary, Jr., Ph.D.
Purdue University, 1955

Major Professor: Herbert C. Brown

A detailed study has been made of the perchloric acid catalyzed mercuration of benzene and toluene in glacial acetic acid at 25°, 50° and 75°. Under the experimental conditions the isomer distribution in toluene changes with time and approaches a statistical distribution of the tolylmercuric acetates. By extrapolating the data to zero time it has been established that the three isomers are formed at 25° with the distribution: *ortho*, 21.0 ± 0.5; *meta*, 9.5 ± 0.5; and *para*, 69.5 ± 1.0%. At 50° the distribution is: *ortho*, 20.0; *meta*, 11.5; and *para*, 68.5%. At 75° the observed distribution is: *ortho*, 18.3; *meta*, 12.6; and *para*, 69.1%. At 25° both competitive experiments and absolute rate measurements lead to a toluene/benzene reactivity of 7.9 ± 0.2. At 50° and 75° this ratio changes to 7.0 and 5.9, respectively. These data are consistent with the linear relationship previously proposed to account for isomer distribution in toluene substitutions and thereby remove a discrepancy provided by the mercuration data previously available.

A study has been made of the reaction of benzene and toluene with mercuric acetate in glacial acetic acid in the presence and absence of perchloric acid and sodium perchlorate. As previously reported by Westheimer and co-workers, the presence of perchloric acid results in an enormous enhancement of the rate of reaction (the rate of mercuration of toluene at 25° proceeds 2000-fold faster in the presence of 0.095 M perchloric acid). On the other hand, sodium perchlorate results in a relatively minor increase (the rate of mercuration at 25° proceeds 5-fold faster in the presence of 0.092 M sodium perchlorate).

From the rates of reaction of benzene and toluene with mercuric acetate at several temperatures, the toluene/benzene reactivity ratios are determined to be 5.0, 4.3 and 3.6 at 50°, 70° and 90°, respectively. The results indicate that the attacking species in the uncatalyzed reaction is a less selective agent than that involved in the perchloric acid-catalyzed reaction. The uncatalyzed reaction of toluene with mercuric acetate at 50° produces the monosubstituted isomers with the distribution: *ortho*, 30.7; *meta*, 13.2; and *para*, 56.1%. At 70° the distribution is: *ortho*, 32.0; *meta*, 14.5; and *para*, 53.5%. At 90°, the distri-

bution is: *ortho*, 32.5; *meta*, 15.7; and *para*, 51.8%. These distributions are in accord with the linear relationship previously proposed to account for isomer distribution in toluene substitutions.

The rates of mercuration of the polymethylbenzenes and a series of monoalkylbenzenes have been determined using mercuric acetate in glacial acetic acid at 50°. The relative reactivities of the polymethylbenzenes may be calculated from partial rate factors as previously outlined by Condon for the halogenation reaction. Agreement of 6% between the experimental and calculated reactivities was found by taking account of steric effects in the *ortho* partial rate factors. It was found that *t*-butylbenzene mercuration is 36% slower than does toluene under these conditions. This result may be explained entirely by assuming that little or no *ortho* isomer is formed in *t*-butylbenzene.

Extension of the Hammett equation to electrophilic aromatic substitution reactions is proposed. The usual side-chain substituent constants, σ , are not suitable for such electrophilic reactions. Consequently, new σ' -values are advanced which permit the quantitative treatment of directive effects in aromatic substitutions. To obtain these constants, a value of unity is assigned to the reaction constant, ρ' , for the reaction of aromatic systems with hydrogen fluoride-boron trifluoride. Using the values for σ' for *meta* and *para* methyl, it is possible to calculate ρ' for a number of different substituent reactions, as well as values of σ' for a number of substituents. Plots of σ vs. σ' for substituents in the *meta* position give a linear relationship. Similarly, a plot of the higher of the two values of σ for substituents capable of resonance interactions versus σ' indicate a linear relationship. Utilizing this relationship, σ' -values can be estimated for numerous substituents for which quantitative rate data are not available. These σ' and ρ' values can be used to estimate isomer distributions in aromatic substitutions. Good agreement is obtained for the *para*/*meta* ratios calculated in this way with the ratios observed experimentally. The use of the usual σ -values does not reproduce the experimental data.

The treatment has been extended mathematically to polysubstituted benzene derivatives and is shown to be identical with previous relationships demonstrated empirically for the chlorination and mercuration of the methylbenzenes.

It is pointed out that *ortho* and *meta* reactivities in electrophilic substitutions generally follow a relationship similar to that previously proposed for *para* and *meta* substitution. Only in the case of mercuration, chloromethylation and isopropylation are serious deviations observed. It is concluded that these deviations must result from relatively large steric effects. Consequently, it appears that the Hammett equation can also be extended to include *ortho* substitutions in electrophilic aromatic substitutions where the steric factor is moderate or small. It is suggested that the extent of the deviations may provide a measure of the magnitude of the steric factor in substitution reactions with large steric requirements.

The phase diagrams for systems of hydrogen

chloride with pyridine bases were determined. In the case of 2,6-di-*t*-butylpyridine, a 2:1 addition compound exists whereas the 1:1 compound is notably absent. Pyridine, 2-picoline, 2,6-lutidine and 2-*t*-butylpyridine form both 1:1 and 2:1 compounds. To account for these results, it is proposed that the bulky *t*-butyl groups exclude the chloride species from the transferred proton to such a degree that cation-anion stabilization cannot be obtained. Consequently, the chloride ion achieves stabilization by forming a hydrogen bond with another molecule of hydrogen chloride. It has also been found that pyridine compounds form higher hydrochlorides at lower temperatures in a manner similar to that of potassium fluoride and hydrogen fluoride.

232 pages. \$2.90. MicA 55-1309

POLYNUCLEAR AROMATIC HYDROCARBONS: SYNTHESES IN THE PICENE SERIES

(Publication No. 11,910)

Earl James McWhorter, Ph.D.
Cornell University, 1955

The object of this study was to extend the scope of a new synthetic route to picene by showing that the method can be used to make a substituted picene, and at the same time to increase the number of known methylated members of the series by the synthesis of 4-methylpicene. In the synthetic scheme the starting material, 9,10-dihydrophenanthrene, formed the three inner rings of the picene nucleus and the two outer rings were added by modifications of the succinic anhydride synthesis of aromatic rings.

An important intermediate in the synthesis, ethyl γ -(9,10-dihydro-2-phenanthryl)valerate, was prepared by two routes. In one method 9,10-dihydrophenanthrene was condensed with succinic anhydride by a Friedel-Crafts reaction to give β -(9,10-dihydro-2-phenanthroyl)propionic acid. This acid, when treated with methyl magnesium iodide, gave γ -(9,10-dihydro-2-phenanthryl)- γ -valerolactone which was reduced to the corresponding acid. Esterification of this acid gave the desired ester. This compound and all subsequent ones in the synthetic route were new compounds. The amide derivative of this acid was also prepared. The second method of preparation of this ester was a one step synthesis involving an aluminum chloride catalyzed condensation of 9,10-dihydrophenanthrene with ethyl allylactate. This reaction was complicated by formation of a considerable amount of dialkylated product and in some cases by oxidation of the dihydrophenanthrene to phenanthrene.

A Friedel-Crafts condensation of ethyl γ -(9,10-dihydro-2-phenanthryl)valerate with β -carbomethoxypropionyl chloride gave 2-(3-carbomethoxypropanoyl)-7-(1-carbomethoxy-3-butyl)-9,10-dihydrophenanthrene. Catalytic reduction of the carbonyl group of this

compound gave 2-(3-carbomethoxypropyl)-7-(1-carbomethoxy-3-butyl)-9,10-dihydrophenanthrene which in turn was converted to 2-(3-carbomethoxypropyl)-7-(1-carbomethoxy-3-butyl)phenanthrene. All three of these esters were viscous oils that could not be crystallized. The corresponding acids were solids, however, and were characterized by their melting points and analyses. The acid derived from the last ester, 2-(3-carboxypropyl)-7-(1-carboxy-3-butyl)phenanthrene, was cyclized with polyphosphoric acid to a diketone. Theoretically, four isomeric diketones could be formed, but only one compound was isolated in a significant yield. This proved to have the same carbon ring system as picene, that is, it was 1,12-diketo-4-methyl-1,2,3,4,9,10,11,12-octahydopicene, since on reduction followed by aromatization a compound was obtained with an ultraviolet spectrum very similar to that of picene. The other isomeric diketones theoretically possible would give aromatic ring systems whose ultraviolet spectra would be quite different from that of picene. In one run a trace of compound was obtained whose ultraviolet spectrum corresponded to one of the other possible isomers. However, the material was such a small percentage of the initial diketone that it could not be considered representative of the starting material.

The material obtained by reduction and aromatization of the diketone had a melting point very similar to that of picene. Its infrared spectrum was quite different from that of picene, however, and for this reason the compound was considered to be 4-methylpicene.

The ultraviolet spectra of the intermediates in the synthesis are given as well as the ultraviolet and infrared spectra of 4-methylpicene itself.

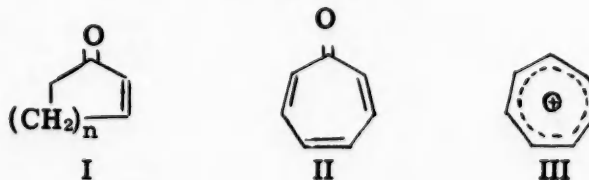
91 pages. \$1.14. MicA 55-1310

PART I: SYNTHESES OF CYCLOALKENONES. PART II: SYNTHESES OF TROPONE. PART III: SYNTHESES AND PROPERTIES OF CYCLOHEPTATRIENYLUM SALTS.

(Publication No. 12,135)

David Lee Pearson, Ph.D.
University of Washington, 1955

Part I of this thesis deals with syntheses of 2-cycloalken-1-ones (I), Part II with syntheses of tropone (II), and Part III with syntheses and properties of tropenium ions (III).



The syntheses of cycloalkenones were a continuation of an extensive survey of general synthetic methods initiated in these laboratories. The Dauben-Youngman approach of allylic bromination of the

cycloalkene, hydrolysis, and chromic acid oxidation has been successfully extended to the preparation of cycloheptenone in 26-40% over-all yield. The use of manganese dioxide for the oxidation of the allylic alcohols in this sequence has been found to be a far superior reagent giving 74-78% cyclopentenone, 80-82% cyclohexenone, and 82% cycloheptenone. The action of dimethylformamide on 2-halocycloalkanones has been shown to afford 34% cyclopentenone, 82% cyclohexenone, and 67% cycloheptenone and to be the preferred synthetic method for the latter two compounds. Several other inferior synthetic methods have been investigated which include pyrolysis of 2-benzoxycycloheptanone obtained by displacement of the corresponding bromide with lithium benzoate in dimethylformamide and hydrolysis of the unsaturated carbonyl derivatives produced in the Mattox-Kendall reaction. The latter has been shown to be applicable only to cyclohexenone.

2,4,7-Tribromotropone has been obtained in 42% yield by an abbreviated synthesis of brominative dehydrobromination of cycloheptanone in acetic acid and a reaction path has been postulated from the product composition of the reaction mixture. The synthesis of tropone (II) from tribromotropone has been improved by inclusion of a lead acetate deactivator in the catalytic hydrogenolysis mixture and the formation of tropone carbonyl derivatives has been confirmed. A far superior method for the synthesis of tropone has been developed which involves brominative dehydrobromination of cycloheptanone in dimethylformamide and affords, according to the reaction conditions, 22% tropone or 28% mixed mono- and dibromotropones. A second method of great potential importance has been indicated by the preparation of 12-18% tropone dipicrate by lead dioxide oxidation of cycloheptatriene in the presence of excess picric acid.

The tropenium ion (III) has been synthesized and its ease of formation, stability, reactions, spectra, and resonance energy are all in good agreement with its formulation as an ionized system possessing a large degree of aromatic character as predicted by Hückel. Four synthetic routes have been developed which include (a) allylic bromination of cycloheptatriene to produce 1,6-dibromocycloheptadiene and 7-succinimidylcycloheptatriene with subsequent hydrogen bromide cleavage of the latter to give 22% (over-all) tropenium bromide, (b) oxidation of cycloheptatriene with sulfur trioxide to afford an unknown tropenium salt in 75% spectroscopic yield, (c) dehydrobromination of 1,6-dibromocycloheptadiene by pyrolysis or liquid sulfur dioxide to form 37% (over-all) tropenium bromide or brominative dehydrobromination of cycloheptatriene in acetonitrile in 65% yield, and (d) carbonium ion exchange between triphenylmethyl salts and cycloheptatriene to afford 92% tropenium perchlorate and 82% tropenium bromide. Substitution reactions of the tropenium ion have been briefly explored and included (a) salt reactions, which showed that interconversion of anion groups was possible by typical inorganic techniques; (b) electrophilic reactions, which indicated the system to be quite resistant to electrophilic attack; (c) radical reactions, which afforded evidence for attack by nitric oxide but

not oxygen; and (d) nucleophilic reactions, which occurred readily. The infrared and ultraviolet spectra of the salts have been found to be in good agreement with its hypothesized structure and the resonance energy of the tropenium nucleus has been estimated to be at least 44 kcal./mole.

291 pages. \$3.64. MicA 55-1311

SYNTHESES AND REACTIONS OF ALLENES AND ACETYLENES

(Publication No. 12,089)

Charles Richard Pfeifer, Ph.D.
University of Maryland, 1955

Supervisor: Professor William J. Bailey

One-Step Synthesis of Allenes. Although allenes are important compounds in the field of organic chemistry because of their highly reactive unsaturation, their potentialities have not been thoroughly investigated due to the lack of a convenient method of synthesis from readily available starting materials.

A convenient one-step procedure for the synthesis of gem-disubstituted allenes from the corresponding acetylenic alcohols was developed in this work. By use of this method 3-methyl-1,2-butadiene, 3-methyl-1,2-pentadiene, and unsym.-pentamethyleneallene were prepared from commercially available acetylenic alcohols. The method involved the shaking of the alcohol with concentrated hydrochloric acid and the addition of the organic product to lithium aluminum hydride. If practicable, it was advantageous to distill the allene directly from the reaction mixture.

Reactions of Nonconjugated Acetylenes with Lithium Aluminum Hydride. Little information was available in the literature concerning the affect of lithium aluminum hydride on nonconjugated acetylenic derivatives.

In developing the synthesis of allenes mentioned above, it was found that lithium aluminum hydride reduction of 3-chloro-3-methyl-1-butyne produced 3-methyl-1,2-butadiene, whereas similar reduction of 3-chloro-3-methyl-1-pentyne produced 3-methyl-2-pentene. It was shown that 3-methyl-1,2-pentadiene was not an intermediate in the latter reaction. Therefore, it was concluded that reduction occurred before dehalogenation in the conversion of 3-chloro-3-methyl-1-pentyne to 3-methyl-2-pentene.

Rearrangement of the triple bond also accompanied dehalogenation in the reaction of lithium aluminum hydride with other propargylic chlorides. Reduction of 4-chloro-2-butyne-1-ol produced 1,2-butadiene-4-ol. 2,4-Dichloro-2,5-dimethyl-3-hexyne was converted to a 2,5-dimethyl-2,4-hexadiene with the formation of a small amount of 2,5-dimethyl-2,3-hexadiene.

The acetylenic hydrocarbons, 3-hexyne and 1-hexyne, were shown to be stable toward reduction with lithium aluminum hydride under ordinary conditions. The stability of the hexynes emphasized the necessity

of having a highly polar group in the compound for the triple bond to be reduced with this hydride.

The reaction of lithium aluminum hydride with a propargylic alcohol led to reduction of the triple bond to the *trans* double bond without rearrangement.

2-Butyne-1,4-diol was converted to *trans*-1,4-diacetoxy-2-butene in a reductive acetylation procedure with lithium aluminum hydride and acetic anhydride.

Acetylenic Monomer. The highly reactive unsaturation in the allenes and the acetylenes merits these compounds a position of considerable interest in the field of polymer chemistry. Previous work in a polymer research program indicated the need of an acetylenic monomer, 1-bromo-2-butyne, for the determination of the properties of three difficultly accessible polymers related to natural rubber.

1-Bromo-2-butyne was obtained from the reaction of 2-butyne-1-ol with phosphorus tribromide. The current use of 1-bromo-2-butyne in the polymer research program mentioned above was described.

45 pages. \$1.00. MicA 55-1312

STUDIES PERTAINING TO THE PHYTOSYNTHESIS OF RUBBER

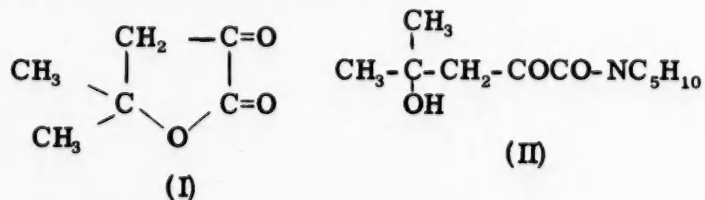
(Publication No. 11,921)

Robert Carl Springborn, Ph.D.
Cornell University, 1955

The mechanism whereby nature produces rubber in various plants is a problem which has challenged scientists for many years. In recent years an increasing number of workers have been attracted to this problem because of the belief that a better insight into the manner of the phytosynthesis of rubber and similar long chain hydrocarbons should add not only to the knowledge of biosynthesis in general, but also contribute to producing better synthetic elastomers.

The present work has been directed mainly to synthetic studies related to a general scheme for the formation of isoprenoid compounds proposed by Hesse. (1) This theory envisages as the key intermediate, α -ketopyroterebic acid, which is considered to arise by condensation of pyruvic acid with acetone or an acetone precursor, such as acetoacetic acid.

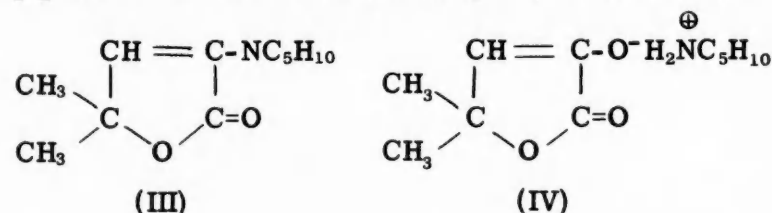
Hesse (1) reported that the *in vitro* condensation of pyruvic acid and acetone in the presence of a methanolic solution of piperidinium acetate gave a crystalline compound, m.p. 61°, which he believed to be α -ketoisocapro- γ -lactone (I).



In a private communication to K. Gerzon, (2) Hesse stated that when the reaction was carried out in aqueous or alcoholic-aqueous media a different compound

was obtained, m.p. 89°, which he suggested could be the piperidide of γ -hydroxy- α -ketoisocaproic acid (II).

In an attempt to obtain α -ketoisocapro- γ -lactone (I) by Hesse's method, Buchanan (3) isolated a small amount of a crystalline compound, m.p. 65°, which contained nitrogen and was shown to be 4-methyl-2-piperidino-2-penteno- γ -lactone (III). In the present work, using an aqueous-methanolic solution, a small amount of a nitrogen containing compound, m.p. 87-88°, was obtained. By direct comparison with an authentic sample this compound was shown to be the piperidinium salt of α -ketosicapro- γ -lactone (IV).



It was also found that the piperidinium salt can be converted to the piperidino compound III merely by heating in an acetic acid-methanol solution for several hours.

A new synthesis of α -ketoisocapro- γ -lactone (I), in satisfactory yields, has been found. This synthesis involves preparing senecieryl cyanide by treatment of senecieryl chloride with anhydrous cuprous cyanide and hydrolysis of the acyl cyanide in cold concentrated hydrochloric acid. The report by Kuhn and Trischmann (4) that hydrolysis of this acyl cyanide gives α -ketopyroterebic acid could not be substantiated.

A large number of approaches to the synthesis of α -ketopyroterebic acid (2-keto-4-methyl-3-pentenoic acid) were investigated. What is believed to be the ethyl ester of this acid (V) was prepared by a Grignard reaction between β -methallylmagnesium chloride



V

and ethyl oxalate. Analysis of the product, b.p. 89.5/9.5 mm., showed only fair agreement with the formula above and no satisfactory procedure for further purification could be found. The product on hydrolysis in boiling water furnished a 90% yield of α -ketoisocapro-lactone, together with a small amount of oxalic acid. In the presence of platinum it took up two atoms of hydrogen and the reduced product, on treatment with semicarbazide, furnished the known semicarbazone of ethyl α -ketoisocaproate. These results indicate that the compound is slightly impure ethyl α -ketopyroterebate (V) or a structurally related compound.

The synthesis of α -ketopyroterebic acid from mesityl oxide, published by Kuhn and Trischmann, (4) was investigated but the reported results could not be confirmed.

101 pages. \$1.26. MicA 55-1313

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I. THE THERMAL OLEFIN-FORMALDEHYDE
CONDENSATION. II. THE SYNTHESIS
AND POLYMERIZATION OF
1,2-DIMETHYLENECYCLOBUTANE.

(Publication No. 11,924)

Joseph Arthur Verdol, Ph.D.
Cornell University, 1955

Part I.

As part of a study concerned with the preparation of new unsaturated systems for use as polymerization monomers, plasticizer intermediates, cross-linking agents, etc., the thermal condensation of isobutylene with formaldehyde was investigated.

Upon heating a mixture of isobutylene and paraformaldehyde (1.5:1 ratio) with acetic acid and acetic anhydride, for 8 hours at 190°, there was formed a 50-60% yield of 3-methyl-3-buten-1-ol acetate and a 13% yield of 3-methylene-1,5-pentanediol diacetate. The latter compound was also obtained in a 50-60% yield by a second condensation of 3-methyl-3-buten-1-ol acetate with paraformaldehyde at 165-170° for 8 hours. The pure hydroxylic compounds, 3-methyl-3-buten-1-ol and 3-methylene-1,5-pentanediol, were obtained in 85% yield by methanolysis of their respective acetates.

Pyrolysis of 3-methyl-3-buten-1-ol acetate produced isoprene in a conversion of 73%, thus providing a new and possibly useful method for the manufacture of isoprene. Catalytic hydrogenation of 3-methyl-3-buten-1-ol acetate afforded isoamyl acetate in a quantitative yield.

Pyrolysis of 3-methylene-1,5-pentanediol diacetate at 485° gave 2-vinyl-1,3-butadiene and 2-(β -acetoxyethyl)-1,3-butadiene. Upon catalytic hydrogenation it was converted in quantitative yield to 3-methyl-1,5-pentanediol diacetate, from which the pure primary glycol, 3-methyl-1,5-pentanediol, was obtained in 85% yield on methanolysis.

Some data is also presented which pertains to the nature of accessory products formed in the isobutylene-formaldehyde condensation.

The behavior of 1-methylcyclohexene in the thermal-olefin formaldehyde condensation was also investigated. The objectives of this study were to develop a new synthetic route to exocyclic dienes and to obtain further knowledge of the reaction mechanism.

When a mixture of 1-methylcyclohexene and paraformaldehyde was heated in acetic acid and acetic anhydride, there was obtained a 54% yield of two isomeric acetates, 2-acetoxymethyl-1-methylenecyclohexane and 3-acetoxymethyl-2-methylcyclohexene, in approximately a 3:2 ratio. The structure and composition of the isomeric mixture was demonstrated by catalytic hydrogenation, pyrolysis, ozonolysis, kinetic analysis with perbenzoic acid, and by ultraviolet and infrared spectra studies.

The formation of two isomeric unsaturated acetates as products of this olefin-formaldehyde condensation indicated a duality of mechanism for the reaction: (1) Intermediate formation of a quasi six-membered ring in the transition state, leading to

the acetate having exocyclic unsaturation, and (2) intermediate formation of a tertiary carbonium ion with subsequent β -elimination of a proton, leading to the "methylcyclohexene" acetate.

Part II.

In order to evaluate the importance of *cis*-configuration in 1,4-linear polymers derived from 1,3-dienes, the exocyclic diene 1,2-dimethylenecyclobutane was synthesized.

The diene was obtained via a 9-step synthesis, starting with adipic acid. The intermediates, with their respective yields in each step, comprised the following: adipic acid \rightarrow dimethyl- α,α' -dibromoadipate (90%) \rightarrow 1-cyano-1,2-dicarbomethoxycyclobutane (66%) \rightarrow 1,2-cyclobutanedicarboxylic acid (88%) \rightarrow diethyl-1,2-cyclobutanedicarboxylate (87%) \rightarrow 1,2-bis(hydroxymethyl)cyclobutane (82%) \rightarrow 1,2-bis(bromomethyl)cyclobutane (90%) \rightarrow 1,2-bis(dimethylaminomethyl)cyclobutane dimethobromide (100%) \rightarrow 1,2-bis(dimethylaminomethyl)cyclobutane dimethohydroxide (100%) \rightarrow 1,2-dimethylenecyclobutane (28%). An alternate synthetic route to the desired diene, pyrolysis of 1,2-bis(acetoxymethyl)cyclobutane, was examined and found to afford only 2-vinyl-1,3-butadiene.

The structure of 1,2-dimethylenecyclobutane was confirmed by its physical properties, including its infrared and ultraviolet spectra. Its structure was also shown chemically by quantitative hydrogenation, ozonolysis to succinic acid and formaldehyde, and by formation of crystalline 1:1 adducts with maleic anhydride and N-phenylmaleimide.

Persulfate initiated polymerization of the diene gave a soluble "rubber-like" polymer in quantitative yield, showing an intrinsic viscosity of 169 cm³ gm.⁻¹ in benzene. Structural analysis of this "rubber-like" substance indicated that about 80% of it had the characteristic "cis" structure of natural rubber.

The thermal dimerization of allene was investigated as an alternate route to 1,2-dimethylenecyclobutane. Dimerization of allene at 500-530° gave a 14% yield of "allene dimer" which contained approximately 65-70% of 1,2-dimethylenecyclobutane.

"Allene" dimer and maleic anhydride reacted at elevated temperatures, affording 1,2,3,4,5,6,7,8-octahydronaphthalene-2,3,6,7-tetracarboxylic dianhydride and bicyclo[4,2,0]-1-octene-3,4-dicarboxylic anhydride.

228 pages. \$2.85. MicA 55-1314

THE PREPARATION AND REACTIONS OF 6-PHENYL-6-DIBENZOPYRYLIUM PERCHLORATE

(Publication No. 12,124)

Lynn George Wiedenmann, Ph.D.
State University of Iowa, 1955

Chairman: Professor R. L. Shriner

INTRODUCTION

The syntheses, reactions and absorption spectra of pyrylium, benzopyrylium, xanthylium and isobenzopyrylium salts have been extensively studied (1). However, very little information is available on 6-dibenzopyrylium salts which are isomeric with xanthylium salts. Decker and Felser (2) reported the preparation of a small amount of 6-phenyl-6-dibenzopyrylium ferrichloride, but its reactions or properties were not studied.

The purposes of this investigation were to develop good methods for preparing 6-phenyl-6-dibenzopyrylium salts in high yields and to study the reactions with electron donor reagents such as water, ethanol, ammonia, primary, secondary, and tertiary amines.

DISCUSSION AND SUMMARY OF RESULTS

1. An improved procedure for the synthesis of 6-dibenzopyrone was devised which gave a yield of 65%. This consisted in treating fluorenone with hydrogen peroxide in acetic anhydride using sulfuric acid as the catalyst. Peroxytrifluoroacetic acid was also found to be an effective agent for converting fluorenone to 6-dibenzopyrone.
2. Treatment of the 6-dibenzopyrone with phenylmagnesium bromide followed by the reaction of the carbinol with perchloric acid gave 6-phenyl-6-dibenzopyrylium perchlorate in 89% yield. The ferrichloride salt was obtained in a similar fashion in only 11% yield.
3. The hydrolysis and ethanolysis of the 6-phenyl-6-dibenzopyrylium perchlorate occurred to produce the 6-phenyl-6-dibenzopyranol and the 6-ethoxy-6-phenyl-dibenzopyran.
4. The 6-phenyl-6-dibenzopyrylium perchlorate reacted with:
 - a. ammonia to produce 6-amino-6-phenyldibenzopyran
 - b. ethylamine to produce 6-ethylamino-6-phenyldibenzopyran
 - c. aniline to produce 6-phenylamino-6-phenyldibenzopyran
 - d. piperidine to produce 6-phenyl-6-piperidindibenzopyran.

In each case the amine hydroperchlorate was the other product. The above compounds could be reconverted easily to 6-phenyl-6-dibenzopyrylium perchlorate by reaction with perchloric acid. The 6-ethoxy-6-phenyldibenzopyran was formed when the hydrochlorides of the above amino compounds were treated with ethanol. The amino derivatives mentioned above failed to form quaternary salts. The

Stuart-Briegleb Models show that the nitrogen atom is buried in the molecule and not readily available for collision and hence reaction with alkylating agents is not possible.

5. The reaction of the 6-phenyl-6-dibenzopyrylium perchlorate with dimethylaniline produced 6-(p-dimethylaminophenyl)-6-phenyldibenzopyran. This compound could not be reconverted to the 6-phenyl-6-dibenzopyrylium perchlorate by perchloric acid. It did react with methyl iodide, benzyl chloride, and methyl p-toluenesulfonate to form quaternary ammonium salts. These results indicated that the reaction involved the formation of a carbon-carbon linkage. Proof of the structure was obtained by an independent synthesis utilizing the coupling reaction between 6-phenyl-6-dibenzopyrylium perchlorate and p-dimethylaminophenyllithium. The product obtained by this procedure was identical with the obtained above.

6. The absorption spectrum of 6-phenyl-6-dibenzopyrylium perchlorate was determined in ethylene chloride as the solvent. Maxima were observed at wavelengths of 257, 345, and 435 mμ. Minima were found at 297 and 383 mμ.

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107 pages. \$1.34. MicA 55-1315

THE SYNTHESIS AND RESOLUTION OF 1,12-DIMETHYLBENZO[C]PHENANTHRENE-5-ACETIC ACID

(Publication No. 12,195)

Richard Melvin Wise, Ph.D.
The Ohio State University, 1955

All aromatic polynuclear hydrocarbon derivatives possessing optical activity due to intramolecular overcrowding which have been prepared thus far racemize readily at room temperature. One purpose of this work was to synthesize a compound which might exhibit greater optical stability than compounds previously prepared. A study of the molecular models indicated that a derivative containing the 1,12-dimethylbenzo(c)phenanthrene system might be such a compound. Another goal of this work was to improve the synthesis of the previously prepared 1,12-dimethylbenzo(c)phenanthrene system so that the synthetic scheme used could be applied to related compounds.

o-Tolualdehyde was treated with malonic ester to form ethyl 2-methylbenzalmalonate (I). I was added to o-tolylmagnesium bromide to produce ethyl

(2,2'-dimethylbenzhydryl)malonate(II). II was reduced to the corresponding diol with lithium aluminum hydride. The dimethanesulfonate of the diol was converted to the dinitrile, and the latter hydrolyzed to β -(2,2'-dimethylbenzhydryl)glutaric acid (III). III underwent double ring closure with polyphosphoric acid to give 5,6,6a,7,8,12b-hexahydro-1,12-dimethylbenzo(c)phenanthrene-5,8-dione (IV). The diol obtained on reduction of IV with lithium aluminum hydride was dehydrated, and the product obtained was dehydrogenated with chloranil to yield 1,12-dimethylbenzo(c)phenanthrene (V) in 19.5 per cent over-all yield from o-tolualdehyde.

The acid chloride of III was cyclized with stannic chloride to produce 1,2,3,4-tetrahydro-8-methyl-4-oxo-1-o-tolyl-2-naphthaleneacetic acid (VI). VI was reduced by the Wolff-Kishner method to yield 1,2,3,4-tetrahydro-8-methyl-1-o-tolyl-2-naphthaleneacetic acid (VII). VII was cyclized with polyphosphoric acid to give 5,6,6a,7,8,12b-hexahydro-5-oxo-1,12-dimethylbenzo(c)phenanthrene (VIII). VIII underwent a Reformatsky reaction followed by dehydration and dehydrogenation to form 1,12-dimethylbenzo(c)phenanthrene-5-acetic acid (IX), m.p., 243-244° w. decomp.

The complete resolution of IX into the pure active acids, m.p., 207-208° w. decomp., was accomplished by means of the cinchonidine salt. Solutions of the active free acids and methyl esters are completely optically stable at room temperature. Little, if any, racemization occurred when a mesitylene solution of the ester was refluxed for one week. The active acids have rotations of $[\alpha]_D^{25} -363^\circ$ and $[\alpha]_D^{25} +348^\circ$.

97 pages. \$1.21. MicA 55-1316

CHEMISTRY, PHARMACEUTICAL

THE ION-EXCHANGE CHROMATOGRAPHIC AND SPECTROPHOTOMETRIC DETERMINATION OF ANTIHISTAMINES

(Publication No. 12,100)

Seymour Morton Blaug, Ph.D.
State University of Iowa, 1955

Chairman: Dean L. C. Zopf

The variety of substituent groups which may be present in the structural unit of antihistaminic compounds has led to numerous methods for the quantitative determination of these compounds. Many of these methods are based on the formation of a colored compound which can be determined in a colorimeter. Other methods used to quantitatively determine antihistamines include titration procedures, gravimetric procedures, and extracting procedures. Several antihistamines have been quantitatively determined by measuring their total nitrogen content. None of these methods is applicable

as a general assay procedure. Furthermore, they are all complex procedures requiring from one to several hours to carry out.

Two methods for quantitatively determining antihistamines have been developed in this study. The study was conducted on ten antihistamines representing the major groups (basic ethers, ethylenediamine derivatives, and monoamines) of antihistamine compounds.

Antihistamine salts, being weak acids, can not be titrated directly. It was found that by passing an alcoholic solution of the antihistamine salt through a weakly basic anion exchange resin, the free base of the antihistamine compound was released and the acid radical was adsorbed by the resin. The free base was eluted from the resin column and determined by direct titration with hydrochloric acid. Salts of weak acids were not completely converted to the free base in the weakly basic resin column. Using a strongly basic resin, antihistamine salts of weak or strong acids were quantitatively converted to their free base form and determined by direct titration.

Pharmaceutical preparations containing an antihistamine were analyzed by passing an aliquot of the preparation through the strongly basic anion exchange resin. Quantitative recoveries were achieved. It was found that pharmaceutical preparations containing inorganic salts could not be analyzed for antihistamine content on a strongly basic resin. The strongly basic resin converts inorganic salts such as sodium chloride and ammonium chloride to the corresponding base. However, quantitative recoveries were achieved using a weakly basic resin which has no effect on inorganic salts.

Many commercial preparations containing an antihistamine, also contain ephedrine. It was found that since ephedrine is a strong base itself, the antihistamine could not be quantitatively determined by ion exchange in the presence of ephedrine. The two compounds were separated by adsorbing the ephedrine on a cation exchange resin which did not adsorb the antihistamine salt. The antihistamine salt was then determined as discussed previously.

The second method for the quantitative determination of antihistamines is a spectrophotometric one. Antihistamines, being aromatic substituted compounds, exhibit ultraviolet absorption spectrums. A spectrogram and a standard curve was constructed for each antihistamine salt used in the study. Excellent conformity to Beer's law was shown by all of the antihistamines studied.

The spectrophotometric method was applied to antihistamine containing pharmaceutical preparations. Recoveries were quantitative in all cases. This method has the advantage of being direct. The presence of inorganic ions or ephedrine did not interfere with the analysis.

The spectrophotometric method was adapted to the analysis of a preparation containing two antihistamines without having to separate the antihistamines. The concentration of each component in the mixture was calculated by the simultaneous solution of two equations containing the data obtained at the absorption bands of the two antihistamines. Additional terms

were necessary in the equations to correct for the interference of one component at the wavelength position of the other.

The two methods developed in this study are accurate, rapid, and applicable to many antihistamines. In addition, the ion-exchange method holds promise of wide applicability in pharmaceutical analyses.

70 pages. \$1.00. MicA 55-1317

THE BARBITURATES IN FORENSIC CHEMISTRY

(Publication No. 12,014)

Gwendolyn Bertha Carson, Ph.D.
The Ohio State University, 1954

Adviser: Clayton S. Smith

Forensic chemistry may be defined as chemistry applied to the solution of legal problems arising in connection with the administration of justice. This field covers the application of chemistry to both criminal and civil investigations and includes making chemical analyses of drugs, medicines and vital organs.

Among the most important drugs encountered in forensic chemistry are the barbiturates, the first one of which was prepared by Emil Fischer and J. von Mering in 1903 and is known as barbitol. This compound became an official drug in 1926. The parent compound was further modified in later years, and several other barbiturates were synthesized and marketed for clinical use.

Statistics on accidental and suicidal deaths due to barbiturates indicate that barbiturates are involved in many medicolegal cases; therefore accurate methods for detecting these compounds in tissues, blood and urine should be developed.

Some barbiturates are readily detected by older methods; however, methods for detecting barbiturates which are metabolized in the body have not been developed in all cases. Color tests are of little value unless the barbiturate is in a pure state, since many substances, including impurities, give the same color tests. Because of the limited quantity of barbiturates isolated from tissues in most cases, it is seldom possible to prepare chemical derivatives.

This investigation was undertaken to determine a procedure which would produce the least alteration of recovered barbituric acids and also to attempt to establish a better method of identification of these drugs.

The behavior of various barbituric acids in 5 per cent potassium hydroxide and 20 per cent acetic acid and of their respective salts in distilled water for 24 hours at room temperature was first determined, since these reagents are commonly used for extracting barbiturates from tissues. After determining the effect of these reagents on barbiturates, the same reagents were employed to extract known quantities of barbiturates from tissues. In one tissue experiment, aqueous solutions of pH 10 were used to extract

the barbituric acids. (This experiment corresponded to that of aqueous solutions of salts of barbituric acids. The pH of such a solution lies between 9 and 10.) The alkali decomposed the barbituric acids to varying degrees; acetic acid did not extract all the barbituric acids; the best recoveries of these drugs were obtained with aqueous solutions at pH 10.

After the barbituric acids are isolated in a pure state, methods of identification are necessary. Melting points are useful; however, several barbituric acids melt within the same range. In order to overcome this difficulty, refractive indices were determined at temperatures above those of the melting points, the temperatures being those at which the readings could best be observed. By this method, these barbituric acids may readily be identified.

The identification of barbituric acids may be hampered by the presence of their decomposition products and also by the effect of the presence of cyanide. Investigations with cyanide and barbituric acids showed that cyanide interfered with the identification of these drugs in some tests. Decomposition products of pure barbituric acids were previously believed to be produced by exposure of barbiturates to atmospheric conditions. However, after exposure of 24 barbituric acids to atmospheric conditions for 60 days, appreciable change was observed in only one acid.

The results of this investigation seem to indicate that (1) the best method of extraction of barbituric acids is obtained with aqueous solutions at pH 10; (2) refractive indices of melted barbituric acids may be used to aid in identification of barbituric acids; (3) cyanide interferes with the identification of barbituric acids in some tests; and (4) atmospheric conditions do not appreciably affect barbituric acids during a sixty day period.

78 pages. \$1.00. MicA 55-1318

CHEMISTRY, PHYSICAL

AN INVESTIGATION OF CERTAIN PHYSICAL PROPERTIES OF AMMONIUM AMALGAM

(Publication No. 12,149)

Mary Jo Boehm, Ph.D.
Michigan State University, 1955

Many of the physical and chemical properties of ammonium amalgam have been reported to be comparable to the properties of the alkali metal amalgams; although the exact manner in which nitrogen, hydrogen, and mercury are combined in ammonium amalgam is unknown. It has been suggested that ammonium amalgam, analogous to the alkali metal amalgams, is either a compound of the "ammonium" radical with mercury, or a solution of such a compound in mercury. Other evidence indicates that the amalgam may be a stable froth which floats on mercury. To gain

further information about the nature of the substance the magnetic properties, the solid-liquid equilibria, the behavior of an electrode, and the compressibility of ammonium amalgam were studied.

Following an investigation of several methods for preparing and handling ammonium amalgam, an electrolytic preparation was adopted, and a means for purifying and manipulating the amalgam at temperatures in the vicinity of -30°C was devised. Acid extraction of the ammonia from the decomposing amalgam provided a means for analyzing samples of the amalgam. In most cases the amalgams on which measurements were made contained less than 0.50 mole per cent of ammonium.

Magnetic susceptibility measurements by the Gouy method at -30°C gave evidence that ammonia and hydrogen were combined with mercury in a way which decreased the freedom of electrons in mercury. Values as large as -0.270×10^{-6} c.g.s.units/gm. were observed for the specific susceptibility of the amalgam as compared to -0.167×10^{-6} c.g.s.units/gm. for the specific susceptibility of mercury. The large increase in the diamagnetism of mercury to which only a small amount of ammonium had been added established that uncombined $\text{NH}_4\cdot$ radicals comparable to alkali metal atoms were not present in the amalgam. Apparently the amalgam is an entity of the type $\text{NH}_4^+\text{Hg}_x^-$ in which the few electrons furnished by ammonium to mercury suffice to remove the temperature independent paramagnetism of mercury. Failure to find a relationship between the composition and the density of the amalgam suggests that the amalgam is partially decomposed at -30°C and contains ammonia and hydrogen gases entrapped in the mercury as well as some ammonium in solution in, or in combination with mercury. The amalgam ordinarily studied thus appears to be a mixture containing gaseous decomposition products.

A study of the solid-liquid equilibria in the system ammonium-mercury showed that about 60% of the ammonia and hydrogen present in the mercury were released during a single freezing and that the decomposition produced by additional freezings was insignificant, although an appreciable quantity of ammonium remained in the mercury. This indicated that some ammonia and hydrogen are very loosely bound to mercury in the amalgam perhaps as entrapped gas and that the remainder is present as ammonium or a compound of mercury with ammonium. The amalgam or possibly a stable froth containing the amalgam floats on top of mercury as indicated from cooling curves obtained simultaneously for each phase of the amalgam in which the cooling curve of the lower phase was not significantly different from that of pure mercury. From the cooling curves it was observed that during the solidification process the temperature of the system increased slightly perhaps as a result of the breaking of some type of bond between the components of the system. Definite freezing temperatures were not obvious from the cooling curves for the amalgam, although the shape of the curves was reminiscent of solid solution formation. If the "true" amalgam exists as a colloidal dispersion or a froth of colloidal particles in mercury then the freezing

curves would be reasonable since only the mercury would freeze at -40°C ; the fusion point of the amalgam would be higher than -40°C .

Ammonium amalgam electrodes were found to be largely irreversible in aqueous ethanol solution at -30°C , although a value of 1.57 volts for the potential of an amalgam electrode in solution with ammonium ions was computed. Only in very dilute solutions immediately after connecting the potentiometer does one observe e.m.f. values approximating those for the alkali metal amalgams.

Compressibility measurements were made on samples of the amalgam. These indicated that the amalgam contained ammonia, which was liquefied during compression, as well as ammonium, in solution with mercury or in combination with mercury.

152 pages. \$1.90. MicA 55-1319

THE KINETICS AND MECHANISM OF THE CYANOHYDRIN REACTION IN METHANOL SOLUTION

(Publication No. 12,078)

Fred Harold Brock, Ph.D.
University of Maryland, 1955

Supervisor: Professor William J. Svirbely

The kinetics of the reaction of propionaldehyde with hydrogen cyanide in buffered methanol solutions have been studied at 25°C under certain controlled conditions. Acetic acid and sodium acetate were used in the preparations of the buffer solutions. To maintain the ionic strength, either sodium nitrate or sodium chloride was added to the reaction mixtures. The reactions were followed by determining the concentration of cyanide using the Volhard analysis.

It was found that the reaction was of the second order, first order with respect to each reactant. At a constant buffer composition, an increase in the ionic strength caused a small decrease in the rate constant.

Experiments were conducted designed to test for the presence of catalysis. Several set of runs at an ionic strength of 0.200 were made at a constant buffer ratio and at varying buffer compositions. At the same acid concentration, the rate constant was increased when the ratio $(\text{OAc}^-)/(\text{HOAc})$ was increased. With increasing buffer composition, but at the same buffer ratio, the rate constant increased also. This phenomenon proves the presence of general catalysis. When the value of the rate constant at the same buffer ratio was plotted against the acid composition, strict linearity was not observed.

During the course of the work, a new method was developed for plotting data in order to solve for the values of the catalytic rate constants. This procedure was used to correlate the data. This new procedure was also applied to Bronsted's data on the inversion of glucose. Agreement in the calculated results by Bronsted's method and by this new procedure was as good as could be expected.

Analysis of the data indicated that the formation of the cyanohydrin of propionaldehyde was subject to both general acid and general base catalysis. A mechanism consistent with these facts has been postulated. It involves hydrogen bond formation between the carbonyl oxygen of the free aldehyde and the acid acting as the electrophilic reagent; a push by the base, the nucleophilic reagent, on the carbonyl carbon, followed by addition of cyanide ion.

The concentrations of free aldehyde in methanol and in water are affected by solvolysis reactions, namely hemiacetal formation and hydration, respectively. Under comparable conditions, the experimental rate constant in methanol is smaller than that in water. Taking into consideration the values of the equilibrium constants for these reactions, the true rate constant for cyanohydrin formation in methanol is greater than that in water. The variation in the rates in these two solvents is then in agreement with theory as to medium effects.

Due to the method of chemical analysis, the error in the plot for the evaluation of the rate constant increases as the concentrations of the reactants decrease. A mathematical treatment was therefore devised by which the rate constants may be calculated. This procedure incorporates a weight factor in the method of least squares.

108 pages. \$1.35. MicA 55-1320

ELECTROKINETIC PROPERTIES OF FLEXIBLE CHAIN POLYELECTROLYTES

(Publication No. 12,162)

Lewis Bsharah, Ph.D.
The Ohio State University, 1955

The diffusion and electrophoretic properties of the polyelectrolyte, poly-4-vinyl-N-n-butyl pyridinium bromide in aqueous HBr solutions have been studied. The electrophoretic mobilities were found to increase with increasing polyelectrolyte concentration and to decrease with increasing HBr concentration. The mobility of the polyion at infinite dilution of polyion and HBr was found to be 3.31×10^{-4} cm²/sec/volt at 20°C. The descending boundary at higher HBr concentrations (0.04 N and above) displayed more moving boundaries than could be accounted for by the number of species present.

The charge on the polycation was obtained from the observed mobility and the area of the δ boundary in the schlieren pattern by using the method of de Wael and Wegelin. Values greater than the theoretical maximum were obtained at low HBr and high polyelectrolyte concentrations. This was ascribed to a limitation of the method of de Wael and Wegelin in which an assumption of constant mobility of the polyion for variable polyion concentrations was made. Correct values of charge were obtained by an extrapolation of apparent charge to zero PVP concentration. The theoretical maximum charge of 2300 equivalents/mole was obtained for the polyion at

infinite dilution of PVP and HBr. Equivalent sphere and stiff rod models were used to calculate charge on the polyion over a range of HBr concentrations from mobilities and the sedimentation constants of PVP at zero PVP concentration. The curves of charge versus HBr concentration obtained for these two models did not follow the curve obtained experimentally from the use of the procedure of de Wael and Wegelin, but gave charges which were lower at most HBr concentrations. The stiff rod model gave a charge at zero HBr concentration which was 1780 equivalents/mole, compared with the theoretical value of 2300 equivalents/mole. The stiff rod appeared to be the best of the two models tested for low HBr concentration. From analysis of the electrophoretic behavior of PVP by the procedure of de Wael and Wegelin and by the stiff rod model, it may be concluded that PVP is completely ionized at zero PVP and zero HBr concentration.

A new multi-channel diffusion cell was designed and constructed for the measurement of diffusion constant by the free boundary method. The curves of the diffusion constant versus concentration of PVP were similar to those obtained for mobility measurements. The slopes of the HBr curves were in opposite direction to that predicted for a configuration change alone. The charge on the polyion and the pull of its counterions appeared to be the most important factors in determining the diffusion coefficient of PVP. The diffusion coefficient of PVP at infinite dilution of PVP and HBr was found to be 1.30×10^{-7} cm²/sec at 20°C. An extrapolation procedure was used to obtain a diffusion coefficient of 0.89×10^{-7} cm²/sec at 20°C for infinite HBr concentration.

The Onsager equation for the diffusion of electrolytes was tested and found to be totally inadequate for polyelectrolyte systems.

It was concluded that a new theory for the diffusion behavior of polyelectrolyte systems must be developed. 133 pages. \$1.66. MicA 55-1321

INTERFEROMETRIC STUDY OF MOLECULAR DIFFUSION IN BINARY LIQUID SYSTEMS

(Publication No. 12,126)

Colin Spencer Caldwell, Ph.D.
University of Washington, 1955

A method for obtaining the mutual diffusion coefficients in binary liquid mixtures has been developed and evaluated. This technique employed a Mach-Zehnder interferometer to record the concentration distribution within a single-channel diffusion cell, the upper region of which served as the reference section. The high sensitivity of the interferometer fringe pattern permitted the use of small concentration differences between the two original solutions, hence the measured diffusion coefficients could be considered differential coefficients. In order to obtain reproducible starting conditions for each experiment, a double-slit boundary sharpening arrangement was

used. This method differs from previous interferometric techniques in that diffusion between solutions of volatile solvents can be investigated in the specially designed diffusion cell which requires no greased joints or sliding sections. The interference fringe patterns were identical with those obtained with a Rayleigh - type interferometer, and hence the data could be evaluated conveniently by means of the maximum ordinate area method.

An analytical study of the error due to refraction in the region of maximum refractive index (or concentration) gradient showed that the resultant deviations in fringe position could be neglected for conditions encountered in this work. In addition, the disturbance to normal diffusion caused by the presence of a diffuse boundary sharpening zone has been analyzed and has been found to contribute a negligible error to the observed diffusion coefficient.

In order to determine the true diffusivity-concentration relationship for an ideal solution, this interferometric technique was used to determine the diffusion coefficients of the systems chlorobenzene-bromobenzene, toluene-chlorobenzene, and benzene-carbon tetrachloride over the entire concentration range at temperatures of 10°, 27°, and 40°C., with an average precision of about one percent. The deviations from linearity of the diffusivity-mol fraction curves were found to increase with decreasing temperature and with increasing dissimilarity of the two components. The data from these simple systems were also used to test the current elementary theories of liquid diffusion. Although the Eyring rate-process concept satisfies the requirement for an exponential temperature dependence of the diffusion coefficient, it appears to be unsatisfactory for general quantitative application. The semi-empirical correlations proposed by Arnold and Wilke fit the data well at infinite dilution, while the relationship between diffusivity, viscosity and mol fraction proposed by Roseveare, Powell, and Eyring is shown to be valid when used at a single temperature.

The non-ideal system methanol-benzene has also been studied over the entire concentration range. The extreme negative deviations from ideal behaviour are discussed in the light of the hydrogen-bonded alcohol structure as determined by spectroscopic and thermodynamic measurements.

193 pages. \$2.41. MicA 55-1322

HEATS OF FORMATION OF TITANIUM TRICHLORIDE AND TITANIUM DICHLORIDE

(Publication No. 12,167)

David Geyer Clifton, Ph.D.
The Ohio State University, 1955

The heats of formation of titanium trichloride and titanium dichloride were determined at 298° K. They were based upon the heat of formation of titanium tetrachloride.

The difference between the heats of formation of

TiCl_{4(l)} and TiCl_{3(s)} was obtained by measuring the heats of solution of these two compounds in a solvent of HCl and FeCl₃. Using the heats of these reactions, and the heat of the oxidation reaction of FeCl_{2(soln)} with Cl_{2(g)} to FeCl_{3(soln)}, the difference between the two heats was calculated. It was found to be -19.9 ± 0.3 kcal/mole at 298° K.

By using the heats of solution of TiCl_{4(l)} and TiCl_{2(s)} in a solvent of HCl and FeCl₃, and the heat of the oxidation reaction of FeCl_{2(soln)} with Cl_{2(g)} to FeCl_{3(soln)}, the difference between the heats of formation of the tetrachloride and the dichloride was obtained. It was found to be -68.8 ± 0.5 kcal/mole at 298° K. In this series of reactions corrections were made for hydrogen evolution which occurred.

By using the heats of solution of TiCl_{3(s)} and TiCl_{2(s)} in an HCl solution, and the partial molal enthalpy of the HCl in the HCl solution, the difference between the heats of formation of the trichloride and the dichloride was obtained. It was found to be -48.5 ± 0.85 kcal/mole at 298° K.

These heats of solution were all made in an ice calorimeter at 0° C. The calorimeter was similar to the one constructed by the National Bureau of Standards (Ginnings, Douglas, and Ball, J. Res. NBS 45, page 23, (1950)). The main difference is the use of a dilatometer instead of the weight method to determine the volume changes.

By coupling the above measurements with the value recently reported by Prosen (Johnson, Nelson, and Prosen, Unpublished Results, Reported to the Office of Naval Research in National Bureau of Standards Report No. 3663 (1954)), for the heat of formation of TiCl_{4(l)}, -192.9 ± 0.6 kcal/mole, the heats of formation of the lower chlorides were calculated.

The heat of formation obtained for TiCl_{3(s)} is -173.0 ± 0.7 kcal/mole at 298° K.

Two values were obtained for the heat of formation of TiCl_{2(s)}. The most precise value is -124.1 ± 0.8 kcal/mole, obtained from the measurements on the heats of solution in HCl and FeCl₃. The second value, -124.5 ± 1.0 kcal/mole, was obtained from the measurements of the heats of solution in aqueous HCl.

74 pages. \$1.00. MicA 55-1323

AN INVESTIGATION OF THE POTASSIUM-MERCURY SYSTEM BY X-RAY DIFFRACTION

(Publication No. 12,102)

Ernest John Duwell, Ph.D.
State University of Iowa, 1954

Chairman: Professor Norman C. Baenziger

The potassium-mercury system has been investigated by X-ray diffraction techniques. The structures of two compounds, K₂Hg and K₂Hg₂, have been determined.

K₂Hg is a gold colored compound with a melting point of 178°C. From precession camera data, the

unit cell was found to be triclinic with $a = 6.59 \text{ \AA}$, $b = 6.76 \text{ \AA}$, $c = 7.06 \text{ \AA}$, $Z = 4$, $\alpha = 106^\circ 57'$, $\beta = 101^\circ 52'$, $\gamma = 92^\circ 47'$, $V_x = 294 \text{ \AA}^3$, and $V_m = 296 \text{ \AA}^3$ (E. Maey, *Z. Physik. Chem.*, 29, 1899). The space group $P\bar{1}$ was assumed and subsequently proven correct.

The y and z parameters of mercury were found by trial and error from $(Ok\bar{l})$ data; the x parameters of mercury were determined from a (hkO) Patterson projection. An $(Ok\bar{l})$ electron density map gave the y and z parameters of potassium, but the (hkO) electron density map did not yield the x parameters of potassium. Therefore, the x parameters of potassium were estimated from spatial considerations and further refined by a least squares method.

The parameters determined from electron density maps were refined by Fourier methods and the errors in the parameters were estimated by Cruickshank's method. Estimates of the errors in the potassium x parameters were made from the least squares evaluation. The standard error is $\pm .005 \text{ \AA}$ for the mercury positions and $\pm .05 \text{ \AA}$ for the potassium positions.

The atomic positions for the space group $P\bar{1}$ are: x, y, z ; $\bar{x}, \bar{y}, \bar{z}$ with

	x	y	z
Hg ₁	0.198	0.101	0.286
Hg ₂	0.877	0.303	0.049
K ₁	0.281	0.653	0.489
K ₂	0.675	0.794	0.166

KHg₂ is a hard, silvery compound with a melting point of 278°C . The unit cell is orthorhombic with $a = 8.10 \text{ \AA}$, $b = 5.16 \text{ \AA}$, $c = 8.77 \text{ \AA}$, $Z = 4$, $V = 397 \text{ \AA}^3$, and $V_m = 398 \text{ \AA}^3$ (Maey, 1899). The space group is $Imma$.

The parameters were determined by inspection of the $(hOk\bar{l})$ and $(Ok\bar{l})$ data and were refined by electron density projections as for KHg. The atomic positions are

$$(0, 0, 0; \frac{1}{2}, \frac{1}{2}, \frac{1}{2}) +$$

8 Hg in (i): $x, 1/4, z$; $\bar{x}, 3/4, \bar{z}$; $\bar{x}, 1/4, \bar{z}$; $x, 3/4, z$;
with $x = 0.190$, $z = 0.087$.

4 K in (e): $0, 1/4, z$; $0, 3/4, z$; with $z = 0.703$.

The standard error is $\pm .003 \text{ \AA}$ for the mercury position and $\pm .06 \text{ \AA}$ for the potassium positions.

An interesting feature of these compounds is that the mercury atoms are in square planar clusters of four. In KHg the clusters are joined at the corners to form a chain, while in KHg₂ each mercury atom in the cluster has an additional bond to form a three dimensional net. KHg₂ may also be thought of as having a distorted aluminum boride structure, where the distortion is caused by the too large potassium atoms. The mercury-mercury distances are essentially identical to the interatomic distances in solid mercury, while the bond distances between potassium and mercury and between potassium atoms is about eight per cent less than expected on the basis of the distances in the elements.

Another phase tentatively labeled K₅Hg, has been shown to have an orthorhombic unit cell. The cell

constants are $a = 9.99 \text{ \AA}$, $b = 19.23 \text{ \AA}$, $c = 8.25 \text{ \AA}$, $Z = 4$, $D_x = 6.70$, $D_m = 6.61$, and space group = $Pbcm$.

KHg₁₁ has been shown to be isostructural with BaHg₁₁, SrHg₁₁, and RbHg₁₁. The structure of BaHg₁₁ has been reported by G. Peyronnel, (*Gazz. Chim. Ital.*, 82, 679-80, 1952). 89 pages. \$1.11. MicA 55-1324

TRANSFERENCE NUMBERS OF ZINC SULFATE

(Publication No. 11,933)

Robert M. Gold, Ph.D.
New York University, 1954

Adviser: Professor Cecil V. King

In attempting to measure the transference numbers of zinc sulfate by the Hittorf method, it was difficult to obtain accurate results with the classical type of static apparatus (divided into anode, middle, and cathode sections). This was shown to be due to the lack of 100% metal efficient electrodes, which resulted in the liberation of hydronium and hydroxyl ions at the anode and cathode respectively. As a consequence, an appreciable part of the electrolysis current was being carried by ions other than Zn^{++} and SO_4^{--} .

To circumvent this difficulty, a dynamic type of apparatus was constructed. By means of a controlled rapid solution flow, the hydronium and hydroxyl ions were continuously swept back into the anode and cathode compartments respectively. With this apparatus, the transport numbers of zinc sulfate were measured over the range of 0.05 to 1.9 molal. The values of t_+ go from 0.381 at 0.05 molal to 0.23 at 1.9 molal. The results agree with recent values obtained via the Electromotive Force method (E. R. Purser and R. H. Stokes, *J. Am. Chem. Soc.*, 73, 5650, 1950).

37 pages. \$1.00. MicA 55-1325

THE CONFIGURATION OF GELATIN IN SOLUTION

(Publication No. 11,902)

Edward Vernon Gouinlock, Jr., Ph.D.
Cornell University, 1955

An introduction to the general characteristics of gelatin and its physical properties in solution has been presented, in addition to a summary of the research pertinent to this thesis which has been heretofore reported.

The general theory of molecular configuration and of frictional and hydrodynamic properties of high polymers and proteins in solution has been outlined. In addition, a description of the osmotic pressure and light scattering theory of large molecules has been included.

A description of the fractionation and characterization of the gelatin samples and a discussion of the

equipment and methods involved in light scattering, sedimentation and viscosity measurements are presented.

Measurements are reported for two gelatin fractions in a 1 M KCNS solvent at ca. 30°C and a pH of 6.5 (gelatin $I_p=5.0$) and for unfractionated gelatin in two solvents. For the fractions, light scattering molecular weights M_w , root-mean-square end-to-end distances $(r^2)^{1/2}$, and second virial coefficients A_2 have been evaluated in addition to sedimentation constants at infinite dilution $(S_{30}^1)_0$ and intrinsic viscosities $[\eta]$. The molecular weights, 596,000 and 383,000, are the largest yet reported for gelatin. The second virial coefficients indicate that the solvents used are thermodynamically "good" ones for the samples studied. The significance of the experimental quantities is discussed, and a variety of parameters and other quantities arising from the hydrodynamic and configurational theory of polymers and proteins have been calculated. An analysis of the experimental errors involved in each of the determinations is given.

It is shown that the earlier hydrodynamic treatment of proteins in terms of a rigid and dense ellipsoid of revolution is completely unsuccessful in accounting for the gelatin data, and some of the fallacies inherent in the model are discussed. The parameter β , arising from the hydrodynamic theory of proteins in terms of an effective hydrodynamic ellipsoid, has been evaluated for the two fractions. The average value is $1.60 \pm 0.03 \times 10^6$. The minimum permissible value theoretically is 2.12×10^6 , and both sample heterogeneity and a conservative estimate of experimental error are insufficient to account for this discrepancy.

The experimental values for the universal constant of intrinsic viscosity Φ , 1.6 and 1.3×10^{21} , are in substantial agreement with the accepted value of 2.2 to 2.5×10^{21} if the experimental error and the large correction for polydispersity are considered. The values for the translational frictional constant P , 7.2 and 6.9, which are subject to a heterogeneity correction greater than one, are at variance with the accepted value of 5.1 by an amount exceeding a conservative estimate of error.

No explanation for the discrepancies encountered in the experimental β and P values is available.

A discussion of the configuration of gelatin in solution in terms of chain statistics is presented. It is concluded that gelatin is a highly flexible molecule and comparable in its unperturbed configuration to synthetic linear polymers. On this basis, the gelatin is found to be coiled in solution to a small fraction of its extended length. A value of 2.1 has been found for the ratio of the chain displacement length in the absence of long-range interactions to the value assuming free rotation about all valence bonds.

The calculation of the molecular expansion coefficient α for each fraction is included, together with a discussion of the light scattering results from the point of view of the special effects which may occur in multi-component systems. A discussion of the effect of molecular weight heterogeneity on the parameters β , P and Φ is also included.

140 pages. \$1.75. MicA 55-1326

PHYSICAL-CHEMICAL STUDIES ON THE INTERACTION OF POLY-4-VINYL-N, n-BUTYL-PYRIDINIUM-BROMIDE AND n-ALKYL SULFATES

(Publication No. 12,171)

Elton Harold Hall, Ph.D.
The Ohio State University, 1955

The interaction of poly-4-vinyl-N,n-butyl-pyridinium-bromide (PVP) and n-alkyl sulfates in aqueous solution has been investigated under various conditions of ionic strength and mixing ratio.

The alkyl sulfates were prepared by fractionation of a mixture of homologues, and a fractionation procedure was developed based on the unique solubility-temperature characteristics of detergents in general. Two fractions were isolated, neither of which exhibits a minimum in the surface tension vs. concentration curve, a fact which indicates a fair degree of homogeneity with respect to chain length. The critical micelle concentrations were 26×10^{-5} g./ml. and 39.5×10^{-5} g./ml. The first value is somewhat higher than values for sodium hexadecyl sulfate reported in the general literature, which vary between 14×10^{-5} and 21×10^{-5} g./ml. The value for the second fraction is somewhat lower than the values reported for sodium tetradecyl sulfate, which are 63×10^{-9} to 69×10^{-9} g./ml. The first fraction was therefore assumed to be primarily the hexadecyl sulfate, and the second fraction the tetradecyl sulfate.

A new technique for the determination of the weight of alkyl sulfate adsorbed per unit weight of PVP has been developed. The method makes use of surface tension measurements by the pendent drop method to determine the concentration of unbound detergent remaining in an equilibrium mixture of PVP and detergent. The quantity of detergent bound may then be calculated from the known initial amounts of detergent and PVP. The maximum values of the binding in mixtures containing excess detergent were observed to be 1.40 and 1.05 moles of sodium tetradecyl sulfate per quaternized group on the PVP at ionic strengths of 0.1 and 0.5 respectively. In the region of excess PVP, the PVP-detergent complex appeared to be surface-active. In this case the observed surface tension was no longer a measure of the free detergent alone; hence the calculation of the amount bound could not be carried out in this region.

Angular light-scattering techniques were employed at a detergent to PVP weight ratio of 0.0114 in an attempt to extend the determination of binding ratios into the region where surface tension measurements failed. However, at this ratio the interaction leads to very high molecular weight complexes; hence the calculation of the amount bound from the increase in molecular weight is not possible.

A proposed mechanism for the formation of the high molecular weight complexes is presented in which the PVP and detergent first enter into an electrostatic interaction. This is followed by an association of two or more PVP-detergent complexes resulting from Van der Waals attraction between the hydrocarbon chain of a detergent molecule bound to the first PVP and the hydrocarbon chain of another detergent

molecule bound to a second PVP. The proposed mechanism is supported by the fact that mixtures of PVP and sodium hexadecyl sulfate form complexes with significantly larger average molecular weights than mixtures of PVP and sodium tetradecyl sulfate at the same ionic strength. Comparison of experimental with theoretical particle scattering factors has led to the conclusion that PVP alone at ionic strength = 0.2 and PVP-C₁₆ A.S. complex at ionic strength = 0.2 have rodlike shapes while the PVP-C₁₄ A.S. complex at ionic strength = 0.5 is a partially extended coil which is polydisperse.

121 pages. \$1.51. MicA 55-1327

STUDIES ON THE INTERACTION OF DESOXYRIBONUCLEIC ACID WITH ACRIFLAVINE

(Publication No. 12,033)

Harriet Gerletz Heilweil, Ph.D.
The Ohio State University, 1954

Adviser: Quentin Van Winkle

The interaction of a high molecular weight sample of calf thymus desoxyribonucleic acid (DNA), prepared according to the method of Schwander and Signer (*Helv. Chim. Acta*, 33, 1950, p. 1521), with the fluorescent cationic dye acriflavine, 3,6-diamino-10-methyl-acridinium chloride, was studied in the concentration range where soluble complexes are formed and was found to be reversible.

Determinations of the amount of binding were made over a wide range of equilibrium concentrations of unbound acriflavine, at several values of the experimental variables ionic strength (μ), pH, and temperature, by means of the partition analysis method described by Karush (*J. Am. Chem. Soc.*, 73, 1951, p. 1246), using n-hexanol as the organic phase. Equilibrium dialysis experiments gave results in agreement with those obtained by partition analysis. From the results of the partition analysis experiments, it appears that the binding sites on DNA are heterogeneous with respect to their intrinsic affinities for acriflavine. Although a literal interpretation is probably not justified, theoretical binding curves calculated on the assumption that two groups of sites exist, each characterized by an intrinsic association constant, fit the data satisfactorily. k_1 , the equilibrium constant for the formation of the complex containing one molecule of acriflavine per DNA molecule, was calculated from the partition analysis data in three ways, all based upon a Mass Law treatment of multiple equilibria. For each set of experimental conditions, the calculated values of k_1 agree within the limits of the uncertainty in extrapolating to zero free acriflavine concentration. The maximum number of sites available for complexing with acriflavine per DNA phosphate group is estimated to be 0.5 at $\mu = 0.002$ and pH 7, and less at higher ionic strengths.

In order that measurements of the quenching of the fluorescence of acriflavine by DNA might be used

to obtain values for k_1 , a modification was developed of a treatment of fluorescence quenching made by Oster (*Trans. Far. Soc.*, 47, 1951, p. 660). The method involves extrapolation of the initial slopes of fluorescence quenching curves at several acriflavine concentrations to zero dye concentration, thus taking into account the multiple equilibria involved in complexing by a molecule having a number of independent binding sites. Application of this quenching-slope method yielded values for k_1 in agreement with the independent partition analysis results for the DNA-acriflavine system. Although it was not found adequate for the interaction studied, a method suggested for the determination of amount of binding from fluorescence quenching measurements might apply in other cases.

The values for k_1 obtained by the two experimental techniques are: at pH 7 and 25° C., $k_1 = 49 \times 10^5$ at $\mu = 0.002$, 3.3×10^5 at $\mu = 0.10$, and 1.1×10^5 at $\mu = 0.30$; at pH 5.5, $\mu = 0.10$, and 25° C., $k_1 = 1.9 \times 10^5$; and at 4° C., $\mu = 0.10$, and pH 7, $k_1 = 9.4 \times 10^5$. These values are based upon an average DNA nucleotide weight of 331. k_1 decreases somewhat when the pH is decreased from 7 to 5.5, probably because of increased competition of hydrogen ions for the binding sites. While the decrease in k_1 with increasing ionic strength testifies to the electrostatic nature of the DNA-acriflavine interaction, there is evidence that secondary binding forces are important. Fluorescence quenching is believed to be associated with van der Waals interactions between the fluorescent and quenching molecules. ΔH_1° for the DNA-acriflavine interaction is negative and approximately -8 kcal./mole. Furthermore, qualitative findings on the interaction of several compounds with DNA indicate that binding is favored for molecules offering opportunities for van der Waals bonding. ΔS_1° is zero within experimental error, so that it is probable that the macromolecular configuration of DNA does not change significantly upon interaction with acriflavine.

128 pages. \$1.60. MicA 55-1328

ANGULAR LIGHT SCATTERING STUDIES ON THE INTERACTION BETWEEN POLY-4-VINYL-N-n-BUTYL-PYRIDINIUM BROMIDE AND CRYSTALLINE EGG ALBUMIN

(Publication No. 12,034)

Israel Joel Heilweil, Ph.D.
The Ohio State University, 1954

Adviser: Quentin Van Winkle

Angular light scattering measurements between 30° and 135° were carried out with a modified Brice and Speiser commercial photometer on soluble complexes formed between poly-4-vinyl-N-n-butyl-pyridinium bromide (PVP) and crystalline egg albumin (EA), at pH's below the isoelectric point of the protein, as a function of ionic strength and mixing ratio. Filtration of individually prepared solutions through

Millipore disks made it possible to extend the study to regions where extrapolation of data was feasible. Although the PVP-EA system was shown to be an equilibrium system, no minima were observed in plots of reduced intensity as a function of total concentration, even as low as 5×10^{-5} gm/ml. Thus it was possible to utilize equations developed by Geiduschek and Doty (*Biochim. Biophys. Acta*, 9, 1952, p. 609) for the determination of the weight absorption coefficient, δ , the molecular weight and the shape of the complex. Plots of pH as a function of ml. PVP added to various concentrations of EA are similar to those reported by Gibbs, et al. (*Arch. Biochem. Biophys.*, 40, 1952, p. 85), but here the break points were found to be dependent upon r , wt. EA/wt. PVP, but independent of EA concentration, further substantiating that the equilibrium dissociation constant is low. Light scattering measurements were carried out at mixing ratios, r , at which titration data gave a constant pH and where turbidity was time independent.

Interaction increased sigmoidally with decreasing μ and with increasing pH, showing that the interaction occurs, very likely, between the cationic loci on the PVP and the carboxyl groups on the protein, and is primarily electrostatic in nature. No interaction was found at $\mu = 0.01$ when μ was varied at pH 4.6 and $r = 1.0$, nor at pH's below 4.4 at $r = 1.0$ and $\mu = 0.004$. The fact that δ varied linearly with r at $\mu = 0.004$ and pH 4.6 may be a consequence of redistribution of EA molecules among available PVP molecules. The variation of B , the interaction constant for the system, as a function of μ resembles the variation in simple polyelectrolyte systems, and there is a minimum in the B versus pH curve in the neighborhood of the isoelectric point of the protein. As predicted by recent work of Scatchard, B is a quadratic function of the weight fraction of PVP. Examination of the scattering function $P(\theta)$ points out that the shape of the complex is that of a polydisperse coil, and independent viscosity and sedimentation data on the original material evidence that the PVP sample studied was polydisperse. It was interesting to note that in the region studied the square of the mean radius of gyration for the complex increased linearly with the molecular weight of the complex when μ was varied, and decreased linearly when r was increased, showing that the complex is capable of contraction and expansion under various external conditions.

143 pages. \$1.79. MicA 55-1329

THE CRYSTAL AND MOLECULAR STRUCTURE OF 1,4-DITHIADIENE; AND THE X-RAY CRYSTALLOGRAPHY OF, AND A POSSIBLE STRUCTURE FOR, A BORON HYDRIDE IN THE B_6 TO B_9 RANGE

(Publication No. 11,982)

Peter Adam Howell, Ph.D.
University of Minnesota, 1955

Part I The Crystal and Molecular Structure of 1,4-Dithiadene

By use of low temperature X-ray crystallographic techniques a nonplanar six-membered ring with the 'boat' configuration has been established for the molecular structure of 1,4-dithiadene, $C_4H_4S_2$. Molecular parameters, which suggest a model of C_{2v} symmetry, are $C-S = 1.78 \pm 0.05 \text{ \AA}$, $C=C = 1.29 \pm 0.05 \text{ \AA}$, $C=C-S \cong 124^\circ$ and $C-S-C \cong 100^\circ$. The crystals are orthorhombic, the space group is $C_{2v}^{12} - Cmc2_1$, and the unit cell dimensions are $a = 11.28$, $b = 6.41$ and $c = 7.36 \text{ \AA}$.

Part II The X-ray Crystallography of, and a Possible Structure for, A Boron Hydride in the B_6 to B_9 Range

Low temperature, single crystal X-ray photographs have been taken of a boron hydride (MP - 20°C), with unit cell: monoclinic $P2_1/n - C_{2h}^5$, $a = 11.80$, $b = 6.94$, $c = 11.24 \text{ \AA}$, $\beta = 109.2^\circ$; yielding intensities for 659 reflections. Partial three dimensional Patterson analysis followed by several Fourier refinements has led to the conclusion that there are four molecules in the unit cell, each molecule consisting of eight boron atoms. This assumption gives a fair measure of agreement with the $hO\bar{O}$ and hkO data. Future modes of attack on the project are outlined.

Part III Appendices

The first appendix lists the observed structure factor amplitudes for the boron hydride as well as the limiting values for those reflections which were within the sphere of observation but which were too small to observe. The second appendix gives the details of the calculation of the three dimensional Patterson function as used for the boron hydride structure. The third appendix gives details of a general method for the calculation of structure factors using an IBM 602A calculating punch. The fourth appendix gives a mathematical derivation of the Lorentz factor for a general inclination Weissenberg photograph.

102 pages. \$1.28. MicA 55-1330

STUDIES IN MOLECULAR SPECTROSCOPY: THE INFRARED SPECTRA OF COBALT HYDROCARBONYL AND COBALT CARBONYL NITROSYL AND A RAMAN TUBE FOR GASES AT RELATIVELY LOW PRESSURES

(Publication No. 11,641)

Charles Brian Magee, Ph.D.
Purdue University, 1954

Major Professor: Walter F. Edgell

The metallic carbonyl compounds, because of the unique type of bonding that they display, have long been of interest to chemists. Of late particular interest has been directed to cobalt hydrocarbonyl because of its catalytic effect in the oxo process. Electron diffraction had shown that $HCo(CO)_4$ was

tetrahedral and it was postulated that the hydrogen atom was bonded to an oxygen atom in the linear arrangement C-O-H. However, the infrared spectrum of $\text{HCo}(\text{CO})_4$ obtained from 2 to 15 microns by Sternberg et al.¹ showed no bands in the region characteristic of an O-H stretching vibration. Furthermore, the spectrum of $\text{DCo}(\text{CO})_4$ was identical to that of the $\text{HCo}(\text{CO})_4$, and these researchers concluded that none of the bands they observed could be attributed to a motion of the hydrogen atom.

In this work the infrared spectra of $\text{HCo}(\text{CO})_4$ and $\text{Co}(\text{CO})_3\text{NO}$ were determined from 2 to 33 microns. An assignment of the fundamentals for both compounds (based on C_{3v} symmetry) was made by means of analogy with the assignment for $\text{Ni}(\text{CO})_4$ made by Crawford and Cross.² Although the spectrum of $\text{HCo}(\text{CO})_4$ obtained here showed no evidence of an O-H stretch, this work definitely suggests that the hydrogen is bonded to an oxygen atom. The strong band at 703 cm^{-1} , found in the spectra of both $\text{HCo}(\text{CO})_4$ and $\text{DCo}(\text{CO})_4$ by Sternberg, et al., is here interpreted as an O-H bending motion. Not only is this band of the right order of magnitude for such an assignment, but it has no counterpart in the spectra of $\text{Ni}(\text{CO})_4$ or $\text{Co}(\text{CO})_3\text{NO}$. The sample of $\text{DCo}(\text{CO})_4$ used for spectral study by Sternberg et al. contained 35% hydrogen. Hence the band at 703 cm^{-1} that they observed in the spectrum of the deuterated compound might have been due to the hydrogen present. Deuterium would cause this band to shift to about 20 microns which was outside their range of observation.

In the second section of this work a gas phase Raman tube is described. This tube utilizes the four mirror, multiple reflection principle developed by Welsh, et al.³ at the University of Toronto. With this tube it was found possible to record, photoelectrically, the Raman spectra of gases. The results obtained for a number of gases are given. Although this technique has been by no means perfected, this work represents an encouraging beginning.

194 pages. \$2.43. MicA 55-1331

1. H. W. Sternberg, I. Wender, R. A. Friedel and M. Orchin, *J.A.C.A.* **75**, 2717 (1953).

2. B. L. Crawford and P. C. Cross, *J. Chem. Phys.* **6**, 525 (1938).

3. H. L. Welsh, C. Cummings, and E. J. Stansbury, *J. Opt. Soc. Am.* **41**, 712 (1951).

A STUDY OF THE STRUCTURE OF CRYSTALLINE SILVER MERCURIC IODIDE

(Publication No. 12,182)

Clayton Edward Olsen, Ph.D.
The Ohio State University, 1955

Single crystals of silver mercuric iodide were grown for the first time from solution and investigated by the use of Weissenberg and precession X-ray diffraction methods supplemented by spectrometer measurements. This work indicated that the

material (β' -form) as given from solution has a body-centered tetragonal lattice, $a_0 = 6.32\text{ \AA}$ and $c_0 = 12.64\text{ \AA}$ (27°C), two molecules per unit cell, and a symmetry $I\bar{4}$ (almost $I\bar{4}2m$). This does not correspond to the cell size or symmetry reported by Ketelaar.¹

Patterson interatomic vector maps disclose that, in addition to metal atoms in the tetrahedral sites (Hg at 0,0,0; $1/2, 1/2, 1/2$ and Ag at 0,0,1/2; $1/2, 1/2, 0$ and $1/2, 0, 1/4$; $0, 1/2, 1/4$; $1/2, 0, 1/4$; $0, 1/2, 1/4$ or $1/2, 0, 1/4$ and $0, 1/2, 1/4$), there is silver in octahedral sites, but with displacement from the centers of these sites. The iodine atoms are at $1/4, 1/4, 1/8$; $1/4, 1/4, 1/8$; $1/4, 1/4, 3/8$; $1/4, 1/4, 3/8$ ($+1/2, 1/2, 1/2$). To account for the silver in octahedral sites, it is postulated that silver mercuric iodide has iodine vacancies in the lattice produced by substitution of silver iodide for mercuric iodide. Density determinations, chemical analysis of the material, and the anomalous behavior of the dielectric constant at frequencies below 1Kc support this hypothesis.

Single crystal investigations show that there are two low temperature modifications for silver mercuric iodide: the above β' tetragonal phase produced by growth from solution and a β (cubic) phase produced by quenching the high temperature (α) phase. Limited single crystal investigations were also made on the high temperature (α) phase and indicate a structure in agreement with that proposed by Ketelaar.²

Single crystals of cuprous mercuric iodide were grown from solution, and limited single crystal X-ray investigations on this low temperature phase indicated a tetragonal cell, $a_0 = 4.29\text{ \AA}$ and $c_0 = 12.25\text{ \AA}$, one molecule per unit cell, and symmetry $P4/n\text{mc}$. This is not in agreement with the structure proposed by Ketelaar.¹

A method is developed for the quantitative use of peak-heights on Patterson interatomic vector maps.

175 pages. \$2.19. MicA 55-1332

1. J. A. A. Ketelaar, "Structure Determination of the Complex Mercury Compound Ag_2 and HgI_4 and Cu_2HgI_4 ." *Z. Krist.* **80** (1931), pp. 190-203.

2. J. A. A. Ketelaar, "The Crystal Structure of the High-Temperature Modification of Ag_2 and HgI_4 and Cu_2HgI_4 ." *Z. Krist.* **87** (1934), pp. 436-45.

THE DISPROPORTIONATION AND VAPOR PRESSURES OF TITANIUM TRICHLORIDE

(Publication No. 12,187)

Benjamin Smith Sanderson, III, Ph.D.
The Ohio State University, 1955

There is very little thermodynamic information in the literature on the titanium halides. This investigation was concerned with the measurement of the sublimation pressure and the disproportionation pressure of titanium trichloride.

The transpiration method was used to measure the

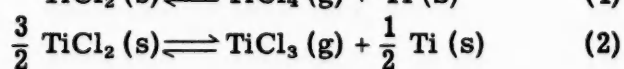
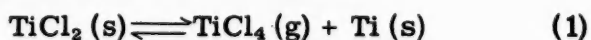
sublimation pressure in the temperature range 628 to 823°K. Helium was used as the inert carrier-gas. The titanium tetrachloride which resulted from the disproportionation was also measured. Using estimated heat capacities, the investigator computed standard heat and free-energy of sublimation as a function of temperature. The heat of sublimation at 298°K was found to be 41.97 kcal mole⁻¹ and the standard entropy of sublimation at 298°K was found to be 41.62 cal degree⁻¹ mole⁻¹.

The disproportionation pressure was determined by a static method in the temperature range 679 to 821°K. The pressure was measured by means of a sensitive pyrex "Spoon Gage." The heat capacities of titanium tetrachloride gas and titanium dichloride solid were estimated. By using these heat capacities and that of the titanium trichloride previously estimated, the equations for the enthalpy-change and the standard free-energy change were computed for the disproportionation equilibrium. The heat and entropy of disproportionation at 298°K was found to be 38.2 kcal mole⁻¹ and 42.4 cal degree⁻¹ mole⁻¹ respectively.

The disproportionation pressure was also determined at different average compositions of the solid phase. This was done by adding or withdrawing measured amounts of titanium tetrachloride and allowing the system to return to equilibrium. These isotherms indicated the possible existence of a solid solution of TiCl₃ in TiCl₂ at TiCl₂-rich compositions.

The disproportionation pressure was also measured by the Knudsen effusion method. This method gave very low results. An analysis of possible errors indicated that the discrepancy between the two methods resulted from a very low accommodation coefficient. The known dimensions of the effusion cell and the two pressures were used to calculate an accommodation coefficient of 3×10^{-4} for TiCl₄ gas on a TiCl₃-TiCl₂ mixture.

By combining thermodynamic data calculated from this investigation with other measured and estimated data, the standard free-energy changes for the following equilibria were calculated.



The results confirmed those of Skinner,¹ who found that TiCl₂ disproportionates by equation (2) as well as by equation (1). 79 pages. \$1.00. MicA 55-1333

1. Skinner, G. and Ruehrwein, R. Paper presented at the Meeting of the American Chemical Society, New York, September, 1954.

KINETIC STUDIES ON THE RATE OF THE RAPID REACTION BETWEEN CERIC SULFATE AND SULFANILIC ACID

(Publication No. 12,192)

Kenneth McGregor Smith, Ph.D.
The Ohio State University, 1955

A rapid-mixing apparatus has been developed for studying chemical reactions in which, as a result of reaction, a change in color is observed. The change in intensity of the light absorbed by the reacting solutions is transformed to an electrical impulse and applied to the screen of an oscilloscope, and the oscilloscope pattern is photographed. The light from the lamp source is modulated by a sector wheel, and after passing through the reaction cell it falls on a phototube. The amplified phototube signal appears on the oscilloscope as a modulated wave, the amplitude of which is a measure of the extent of reaction. The peaks of the wave provide a time scale so that a photograph of a single sweep, adjusted to occur in a time comparable to the time for completion of the reaction, will give a complete concentration-time curve for the reaction.

The mixing chamber is made from a block of polystyrene, and consists of a large hole bored vertically through the block and a smaller hole bored diagonally through the block and intersecting the larger hole tangentially. One reactant solution is located in the vertical chamber between polystyrene plungers, while the other solution is held in the side chamber by another plunger. Application of a downward force to the bottom plunger initiates the mixing of the solutions in what may be described as a static mixer.

Two 5 ml. volumes of aqueous solutions may be completely mixed in 0.16 seconds. This is about 100 times greater than the mixing time obtainable with flow systems, but the longer light path of the static mixer makes it possible to use solutions of possibly 1/10 the concentration of those in flow systems.

It is pointed out that the static mixer presents possibilities for following reactions by measuring changes in some electrical property of the system.

The apparatus has been used to study, at room temperature in 1.0 N H₂SO₄, the rate of formation of the colored intermediate compound which results from the reaction between ceric sulfate and sulfanilic acid. The initial reaction is shown to be first order with respect to each of the reactants.

A spectrophotometer has been used to follow the reaction for longer periods of time than are practical with the rapid mixer. The absorption spectrum of the intermediate has been mapped out and a peak in absorption observed at 500 mμ.

A mechanism for the reaction is postulated in which the first step is the extraction of a hydrogen atom from the amino group by a second-order process to form a radical. After this, either two radicals may react to form an intermediate bimolecular compound or further oxidation may occur before the formation of the dimer. It is not known whether or not the intermediate forms a complex with ceric ion. The intermediate is relatively stable but slowly fades, perhaps as a result of oxidation by cerate ion.

158 pages. \$1.98. MicA 55-1334

SURFACE TENSION OF SOLUTIONS OF ALKALI HALIDES IN LIQUID AMMONIA

(Publication No. 12,283)

Robert Ardagh Stairs, Ph.D.
Cornell University, 1955

The surface tension of ethanol from -80 to 25°C, of liquid ammonia from -75 to -40°C, and of solutions of sodium chloride and bromide and potassium bromide and iodide at -40°C were measured by the method of maximum bubble pressure, and checked by a few measurements by the capillary rise method. The results obtained with ethanol are in satisfactory agreement with existing data. The surface tension of ammonia may be represented by the equation:

$$\gamma = 23.41 - .3371t - .000943t^2$$

with a standard error of 0.15 dynes/cm.

The results obtained with the salt solutions may be expressed in the form $\Delta\gamma (= \gamma - \gamma_0) = Ac - Bc^2$ (c the concentration in moles per liter). The values of the A coefficients found are: NaCl, 2.79; NaBr, 2.76; KBr, 2.44; KI, 1.52, showing a regular decrease with increase in the polarizabilities of the ions, as they do in aqueous solutions.

A calculation is outlined which shows that at very low concentrations, $d\gamma/dc$ should be linearly dependent on the polarizabilities, with negative slope.

55 pages. \$1.00. MicA 55-1335

THE EXCHANGE REACTION BETWEEN STRONTIUM SULFATE SOLID AND ITS IONS IN ACID AND SALT SOLUTIONS

(Publication No. 11,958)

Ellsworth Dow Whitney, Ph.D.
New York University, 1954

A method has been perfected for the large scale production of relatively large, well formed crystals of strontium sulfate and the apparent surface area of these crystals has been measured by two procedures: (1) by a dye adsorption method using methylene blue and (2) by microscopic visual measurement. The use of other dyes has been investigated, and found less satisfactory. The dye adsorption technique gave a specific surface area of 216 cm.²/g.; the visual measurement of 4,484 crystals gave a specific surface area of 398 cm.²/g.

The solubility of strontium sulfate has been determined in: H₂O at 0° and 25° C., in 0.050N, 0.0997N, 0.2030N HCl at 0° and 25° C. and in 1.028N, 1.894N, 2.5N and 4.005N HCl at 0° C.; in 0.010N, 0.1010N, 0.4851N, 0.9981N, and 3.006N H₂SO₄ at 25° and 0° C.; in 0.0010N, 0.0100N, 0.1000N, and 0.5000N Na₂SO₄ at 25° and 0° C., and in 0.0100N, 0.500N, 3.00N, and 5.00N NaCl at 25° and 0° C.; and in 0.1000N and 4.00N NaCl at 25° C. as well as in 1.50N NaCl at 0° C.

Strontium sulfate showed maximum solubility of

2,336 mg./l. at 25° C. in 2.5N HCl and 1,746 mg./l. at 0° C. in the same solvent. The solubility curve of strontium sulfate in H₂SO₄ at 25° was found to have a minimum (26.8 mg./l.) at 0.1010N H₂SO₄ and a maximum value (33.4 mg./l.) at 0.9981N H₂SO₄. At 0° C. the maximum and minimum values appeared at the same acid concentrations, the minimum value being 17.6 mg./l. and the maximum, 21.4 mg./l. No maxima or minima were observed in the solubility of SrSO₄ in Na₂SO₄ solutions, either at 25° or 0° C. In Solutions of NaCl at 25° and 0° C., strontium sulfate showed maximum solubilities in the region of 2N NaCl.

Exchange reactions employing strontium-89 (and in some cases, sulfur-35) as tracers have been carried out in H₂O, 0.050N and 0.2030N HCl at 25° and 0° C.; 6N, 2.008N and 4.024N HCl at 25° C.; 0.010N, 0.100N and 4.00N NaCl at 25° C. and in 0.500N, 3.00N and 5.00N NaCl at 25° and 0° C. Exchange reactions employing strontium-89 have also been performed in 0.010N and 0.5N H₂SO₄ at 25° and 0° C., in 0.1010N, 0.9981N and 3.006N H₂SO₄ at 25° C. in 0.0010N, 0.1000N and 0.5000N Na₂SO₄ at 25° C. and in 0.0100N Na₂SO₄ at 25° and 0° C.

In general, the shape of the exchange-time curves appeared to be exponential. The fastest exchange (in terms of percentage decrease in activity of the solution) were observed for experiments carried out in H₂SO₄ and Na₂SO₄ solutions, the slowest exchange reactions were observed for the NaCl solutions at higher concentrations. In all cases the effect of lowering the temperature was to decrease the exchange rate.

Experiments were also carried out in order to study the influence on the exchange rate of such factors as presence of yttrium, total amount of solid present, rate of agitation of crystals and solution and aging of the crystals in SrSO₄ solutions. Aging for 18 days in H₂O was found to increase the surface area of the crystals by about 100% whereas the surface area of the crystals aged in 6N HCl increased by 130%. Exchange experiments employing these aged crystals showed that the rate of exchange had increased in the case of the crystals aged in 6N HCl, whereas a decrease in the exchange rate was observed with the crystals aged in water. These apparently anomalous results were found to be due to the growth of mold during the aging process with the crystals aged in water.

The experimental data has been analysed in terms of the following possible rate-determining processes: diffusion through the bulk of the solution up to the adsorption layer, diffusion across a bounding liquid film around the adsorbent particle to the crystal-solution interface, exchange at this interface, self-diffusion of the ion through the strontium sulfate lattice proper, recrystallization, and radio-colloid formation. It has been found that one or both of the last two processes can account for the experimental data, but that the other processes can not. On the basis of the data presented, no distinction can be drawn between these two processes, and indeed, radio-colloid formation may be the mechanism through which recrystallization occurs. The possible relationships between the rate of recrystallization and the nature of the medium have been treated.

288 pages. \$3.60. MicA 55-1336

ECONOMICS

ECONOMICS, GENERAL

THE ECONOMICS OF THE FUR INDUSTRY: A STUDY OF A HIGHLY COMPETITIVE INDUSTRY IN A LESS COMPETITIVE ECONOMY

(Publication No. 12,056)

Victor Robert Fuchs, Ph.D.
Columbia University, 1955

This study covers the various branches of the fur industry in the United States, from the raw fur producers through the retailers of fur garments. It is concerned with the period since World War I and primary emphasis is given to the years after World War II.

Two basic problems are selected for study. They are first, the very marked fluctuations in prices, production, and sales which are characteristic of the industry, and second, the failure of the industry to grow with the rest of the economy. Both the study of short run fluctuations and the analysis of secular decline depend upon an understanding of the economic forces at work in every branch of the industry. Each sector is therefore examined individually to determine its functions, its costs, its relationships with its suppliers and customers, and its competitive structure.

The characteristics of raw fur and the conditions of its production and marketing are considered first. The important role of the fur farmers' cooperatives is noted as well as the parts played by the auction companies, dealers, brokers, and factors. There is some discussion of raw fur production abroad and international trade in furs.

The processes, pricing policies, and structures of the fur skin processing and fur garment manufacturing branches are studied next. The former exhibits some evidences of concentration; the latter, which is the most important branch, is an example of intense, atomistic competition. An analysis of short run and long run cost curves based upon the results of personal interviews and checked against statistical tests is presented.

Consumer demand for fur is analyzed with the aid of budget study data, census data of fur sales by state, and variations in fur sales over time. Urbanization and climate are found to be the two most important variables in explaining geographical variation. In the short run, changes in expectations about income and price seem to be the most important determinants.

The two most important factors accounting for the sharp decline in fur sales in the post-World War II period are changes in the distribution of income and changes in the place and manner of living. The wealthier classes and the urban white collar workers formed the heart of the demand for fur garments. They are the groups which have experienced the smallest

relative gains in income in recent years. The changes in place and manner of living which have adversely affected the fur industry include the movement of population westward and southward, and the movement of wealthier classes away from cities to the suburbs.

The analysis of short run fluctuations is based upon an examination of sixteen monthly time series covering most important aspects of fur trade activity from 1946 through 1952. Periods of expansion and contraction are noted and dates of peaks and troughs in general fur activity established. The amplitude and timing of each specific series with respect to these reference dates is calculated and a tentative account of typical behavior during a cycle is presented. The fluctuations are also compared with general business cycles.

The concluding chapter deals with the relationship between competitive structure and inter-industry competition. The writer finds that the relative decline of the fur industry is partly attributable to shortcomings within the industry and that many of these shortcomings are directly related to its highly competitive structure. Current theories and policies with regard to industrial organization in the United States countenance the existence of oligopolistic industries in the interests of "workability." On the other hand, the problems of the atomistic industries are ignored, and their efforts to organize collectively in order to compete more effectively with the oligopolies are often opposed. This is manifestly unfair and may be socially unwise.

247 pages. \$3.09. Mic 55-126

THE NEW YORK CITY BAKING INDUSTRY: A PROFILE STUDY IN LABOR-MANAGEMENT RELATIONS

(Publication No. 11,943)

A. Matthew Lord, Ph.D.
New York University, 1954

Adviser: Dr. Lois MacDonald

This study is not only meant to examine the pattern of labor relations within a given industry, but also constitutes an attempt to obviate the shortcomings which it is believed characterize the "human relations" approach as well as those found in analyses which stress one or two firms or one or two factors within an industry. The present study is intended to remedy these defects through a multi-level examination of the baking industry in New York City. It is believed that an exploration of such factors as the nature of competition within and between various levels of the

industry, the activities of employers' associations in conjunction with so-called "independents," the importance of ethnic influences and demographic changes, varying degrees of role mobility, the presence of several levels of worker skill, the importance of certain personalities in bargaining situations, the matter of worker attitudes towards their jobs, the changing nature of union locals, differing scales of operation and mechanization, changes in market orientation, and a shift in the secular demand for the product will all serve, together with other considerations, to cast considerable light upon what beliefs may exist that patterns of labor relations are nothing more than the result of the mechanistic interplay of obvious and easily ascertainable forces. The study is based upon an extensive interview program. In addition, recourse was had to the records of management, the unions, lawyers, government agencies, employers, associations, and the New York Times.

The use of the "human relations" approach in this analysis could not, alone, have explained the pattern of labor relations as it is found in the industry. Within the machine shop area there exist many elements which should make for labor-management differences. Still, the production workers in these factories have never engaged in a strike. Conversely, the handcraft worker-employer relationship is one characterized by an unusually high level of rapport and understanding. Yet one finds here as many strikes as are to be found anywhere in the industry. In both instances strictly economic considerations form a very important part of the answer.

The use of a one or two firm analysis which included economic as well as other considerations would have also led to a study containing many deficiencies. Among other things, the absence of a cross-sectional technique would have largely excluded an examination and evaluation of the relative influences manifested by the presence of monopolistic and competitive elements in the market. Were such a cross-section not used it is doubtful whether sufficient attention would have been paid to such considerations as the significance of having the same union local bargaining with firms found on at least two of the three levels in the industry, of the different roles played by multi-employer bargaining units within the industry, of what effect the presence of a conflict center has upon bargaining and strikes within the entire industry, and the importance of inter- and intra-union problems and maneuvers.

It is believed that the profile "unit of study" utilized in this analysis will eliminate some of the shortcomings frequently encountered in similar studies and provide the researcher with a technique which can best measure the true importance of all those elements which enter into a consideration of patterns of labor-management relations.

294 pages. \$3.68. MicA 55-1337

ELEMENTS OF A THEORY OF ECONOMIC DEVELOPMENT OF UNDERDEVELOPED COUNTRIES: A GENERALIZATION OF PROJECTED PATTERNS OF ECONOMIC DEVELOPMENT IN COUNTRIES SURVEYED BY THE INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

(Publication No. 11,888)

Ch'ung-tai Lu, Ph.D.
University of Maryland, 1954

Supervisor: Professor Dudley Dillard

The hypothesis of the present dissertation is that from studies of underdeveloped economies that have been made in recent years, it may be possible to discover some common elements which may constitute part of a general theory of economic development of underdeveloped areas. The data are the reports submitted by the missions of experts of the International Bank for Reconstruction and Development to the governments of underdeveloped countries to serve as basis of deliberate action for economic progress.

The mission programs are characterized by an experimental attitude, by gradualism, and by cost consciousness. They are realistic and flexible and are made to meet the postwar needs of the governing bodies of poor areas. The programs focus on public investment in social overhead capital to build a sound foundation for sustained overall growth. Agriculture is to be diversified and is given primary importance, while industry is to play a secondary role. Government action in social overhead and agriculture is more interventionist than in industry. Failure to assign to industry an important role is unique for studies of this type and cannot always be justified. The immediate rates of growth are not high, but possibilities exist for higher rates of progress in the future.

Elements for a theory of economic development of underdeveloped areas implicit in the program reports of the Bank missions are: (1) cultural factors as an integral part of the analysis; (2) the concept of social overhead capital, which has fundamental implications for the concept of capital in general; (3) a special concept of investment; (4) the tendency toward increasing return; (5) enhanced significance of the capital-output ratio; (6) the role of collective action; and (7) the significance of short-run conflict of interests.

Economic development of underdeveloped countries is a comprehensive process. The several elements mentioned above are interrelated. One element may be just another aspect of some others, or may give rise to some further common components. The number of elements and their classification is flexible. The significant conclusion, however, is that despite variation in detail among countries, there appears to exist an essential unity in the process of development and therefore a body of concepts and propositions (theory) generally applicable to underdeveloped countries is possible. The pivotal concept in a theory of economic development of underdeveloped areas is social overhead capital from which other common

elements originate and by which the latter are given unity and coherence. The basic issue in the development of underdeveloped areas concerns the cultural institutions. To make such institutions conducive to progress, the social and intangible nature of capital and investment dominates the private and material aspect. Since investments in social overhead capital are lumpy, their productivity indirect, and their range of utilization wide, later investments will be more productive than initial investments. For the same reasons and because of the widespread and penetrating effects of social overhead capital, collective action is necessary. Furthermore, the service of a public body is needed to reconcile short-run conflict among group interests in both pre-developed and advanced countries.

375 pages. \$4.69. MicA 55-1338

THE IMPACT OF INDUSTRIALIZATION UPON
AGRICULTURE: A STUDY OF OFF-FARM
MIGRATION AND AGRICULTURAL
DEVELOPMENT IN WEAKLEY
COUNTY, TENNESSEE

(Publication No. 11,986)

Joe Allen Martin, Ph.D.
University of Minnesota, 1955

The objectives of this study are: (1) to reveal some of the social and economic characteristics of off-farm migration, and (2) to reveal some of the effects of a reduction in labor supply upon resource use on farms in Tennessee and the Southeast generally. Data used in the study were gathered by personal interview of 181 farm operators in Weakley County, Tennessee in 1951.

The following characteristics of off-farm migration were revealed in the study: (1) Migration is highly selective of the younger age groups in the population; (2) People in the tenure status of hired labor and sharecropper are moving off-farm faster than other tenure groups; (3) Prior to World War II the better educated tended to be selected for movement out, in the period from 1946 to 1951 the level of education was not a significant factor in migration; (4) Information regarding nonfarm employment in distant cities is provided to farm people almost exclusively by members of the family or friends from the community who have moved to the distant cities; (5) A significantly larger proportion of the migrants in the young age group (17-28 years) were married than of the nonmigrant population; (6) A negative correlation was found between acres of crop and pasture land per unit of labor and off-farm migration; and (7) As employment of labor on farm increased, off-farm movement declined.

To analyze the effect of a reduction in labor supply upon farm resource use 124 farms from the sample were divided into two groups for study: fifty-one farms which had lost labor between 1946 and 1951, and 73 farms which had not lost labor. A detailed analysis of changes in resource use over the period indicated

that the farms which lost labor made faster gains toward providing full employment of their labor than farms not losing labor. In land use the farms which lost labor reduced the percentage of land devoted to labor intensive crops - cotton, tobacco, truck crops and corn - and increased the proportion in soybeans and forage crops more than farms not losing labor. No significant difference was found in the rate of new capital investment in labor-saving equipment, fertilizer and improved seed on the two groups of farms. However, the farms that had not lost labor were not actually using labor-saving equipment which had been purchased as extensively in their farm operations as farms that had lost labor.

The findings of the study indicate that the following lines of private and public action should be considered: (1) provide a labor market news service to rural areas in the Southeast; (2) provide better technical training for nonfarm jobs and vocational guidance in rural high schools of the Region; (3) in areas where farm enlargement is needed as the population declines tenure practices, especially leasing arrangements should be studied carefully as possible barriers to needed adjustments; (4) in order to get more effective use of new capital being invested, educational and financing agencies should encourage and assist farmers to make a thorough analysis of their farms to determine how additional capital can be used most profitably.

160 pages. \$2.00. MicA 55-1339

RAW MATERIALS DEVELOPMENT AND
ECONOMIC GROWTH, A STUDY OF BOLIVIAN
AND VENEZUELAN EXPERIENCE

(Publication No. 12,272)

Charles Elmer Rollins, Ph.D.
Stanford University, 1955

The study is concerned with the possibility that generalized economic growth in underdeveloped countries may be brought about via the development, with the aid of foreign capital, of industrial raw materials production in those countries. Since the theoretical treatment of the subject has been somewhat inconclusive, the procedure has been to study intensively two contrasting historical cases, observing the extent to which these specific instances illuminate aspects of the general problem. The countries studied are: Bolivia during the period in which the mining of tin has been undertaken on a significant scale (1900-1950), an instance in which little or no general economic development accompanied the raw material exploitation; and Venezuela during the petroleum era (1920-1953), an instance in which there has been considerable, if rather uneven, concurrent economic growth.

It has been presumed that the chief possibilities for growth through the medium of raw materials exploitation schemes lie in the accrual of fiscal revenues which may be utilized to finance a general development program. For each country an examination has

been made of: (1) government revenues obtained from the raw material operations; (2) the extent to which these revenues were utilized for purposes designed to stimulate economic growth, and the specific projects carried through; (3) the extent to which the private sector responded to this stimulus, and the resultant growth of the economy.

In the case of Bolivia it has been found that government receipts from the tin mining operations were slight and that very few projects intended to promote growth were undertaken; the country's economy has been stagnant.

In Venezuela government receipts from oil have been very large. A large proportion of these receipts has been devoted to projects designed to stimulate growth, and although the response of the private sector and the general results have been disappointing in view of the large volume of fiscal aid, considerable economic advance has occurred.

The Venezuelan case is an exception which is unlikely often to be repeated. Development has resulted there because of the extremely large volume of funds dispersed among a small population in a country with a very considerable natural resource endowment. From 1946 through 1950 Venezuelan fiscal receipts from oil were nearly twenty times the volume of the Bolivian government revenues from tin; receipts of other leading raw material producers among the underdeveloped countries have been at a level much closer to the Bolivian than to that prevailing in Venezuela. If these smaller revenue totals are to be effectively utilized to promote growth they will have to be accompanied by measures which are strongly opposed by those who have invested or might invest their capital in raw material projects. It is improbable that a flow of private capital into raw material production in the underdeveloped countries will occur simultaneously with a rapid economic growth of those countries, since the attainment of the two results have, under present conditions, conflicting requirements.

490 pages. \$6.13. MicA 55-1340

**TRENDS IN MOTOR VEHICLE ACCIDENT
RATES AND MOTOR VEHICLE INSURANCE
COSTS IN MARYLAND, 1943 TO 1953, WITH
PARTICULAR REFERENCE TO SIMILARITIES
AND DIFFERENCES BETWEEN THE ACCIDENT
EXPERIENCES OF FARMERS AND NON-FARMERS**

(Publication No. 11,890)

Irwin Walter Rust, Ph.D.
University of Maryland, 1954

Supervisor: Dr. Paul R. Poffenberger

Since 1940, and particularly since the close of World War II, both the number of highway motor vehicle accidents and the premium rates for motor vehicle insurance have been increasing in Maryland. Two Maryland farm organizations, the Maryland State Grange and the Maryland Farm Bureau Federation,

noted in a joint 1953 tax report that the problem of motor vehicle accidents and insurance costs was important enough to Maryland farmers to merit detailed study. In response to that suggestion, a study of pertinent data covering the years 1943 to 1953 was instituted.

The analysis of 103,486 accident reports supplied by the Statistics Division of the Maryland State Police indicated that there is a statistically significant difference between the per capita accident rate of farmer and non-farmer operators of motor vehicles on Maryland highways, with the difference in favor of farmer operators as being less subject to motor vehicle accidents.

Further analysis of 12,227 accident reports revealed that there was no significant difference between the severity of accidents experienced by farmer drivers and those experienced by non-farm drivers.

Analysis of insurance data contained in reports of the Maryland Insurance Commissioner, together with accident data, indicated that while premiums received have risen from a base of 100 in 1943 to 845 in 1953, the costs of those accidents to insurance companies operating in Maryland had risen in the same period from 100 to 944. Insurance firms had been subjected to a "cost-price squeeze" akin to that experienced by many farmers following World War II.

These rising accident and cost incidences were found to be a function of increased use of highways, increased numbers of motor vehicles in use, and increased costs of repairs and maintenance per vehicle and per accident.

Suggested solutions to the problem of rising accident incidence and cost were stricter requirements for those permitted to operate motor vehicles on public streets and highways, and the direct assumption by society of the cost of risk bearing with respect to the ownership and operation of motor vehicles on public highways. Pending the adoption of these suggestions, farmer drivers should be granted greater discounts in premium rates for motor vehicle insurance than now obtain.

149 pages. \$1.86. MicA 55-1341

**THE ECONOMIC EFFECTS OF VARYING
AMOUNTS OF FORAGE ON THE
ORGANIZATION OF MINNESOTA FARMS**

(Publication No. 11,998)

Jay P. Swanson, Ph.D.
University of Minnesota, 1955

The objectives of this study were: (1) to determine how and to what extent varying the amount of forage used in the crop rotation would effect the farm organization, and (2) how these changes in the farm organization would effect earnings.

Comparisons were made for rotations having 20, 40, and 60 per cent forage. Optimum organizations and earnings were determined, by linear programming methods, for these conditions:

1. Feeds
 - a. Unlimited amounts can be purchased for hogs
 - b. Only commercial feeds can be purchased
2. Labor
 - a. Only family labor is available
 - b. One hired man is available
 - c. Two hired men are available
 - d. Three hired men are available
3. Fertilizer
 - a. Minimum amounts are used
 - b. Recommended amounts are used

These conditions were considered for both the short and the long run on 160, 320, and 480 acre farms.

Under all conditions, when the farmer can purchase no feed grain, varying the amount of forage in the rotation changes the optimum organization, on any given size of farm, only in the amounts of hog and dairy products sold. The optimum organization for a farm when 20 per cent of the cropland is in forage uses hogs as the major livestock process along with a small number of cows. As the amount of forage in the rotation is increased, however, more dairy cows are employed in the organization to utilize idle labor and unused forage. Increasing the amount of forage results in less corn equivalent produced; therefore, fewer hogs can be raised so labor formerly used for hog production is made idle or forced into its next best use, dairy.

In every case, the 20 per cent rotation is the most profitable when feed cannot be purchased. This is true for both the short and the long run when using either past or recommended fertilizer practices.

In the short run, using past fertilizer practices on a 160-acre farm, the 20 per cent rotation not only provides more income but leaves the operator and family more leisure. In the long run, assuming fertilizer use to continue about as in the past, productivity may decline by as much as 10 per cent in ten years on the 20 per cent rotation but it will still be the most profitable rotation.

In the short run, when fertilizer is used in recommended amounts, earnings on all rotations are enhanced but those on the 20 per cent rotation increase the most, thus widening the differential that already exists in the earnings realized by the various rotations.

On the other hand, when feed can be purchased the optimum organization for all rotations is one of specialized hog production. It is more profitable for the farmer to allow forage to go unused and to spend his labor feeding hogs than to utilize the forage in any other way.

Under most conditions, when feed can be purchased, the 20 per cent rotation is the most profitable. The exception to this occurs when large amounts of both "crop season" labor and "winter season" labor are available. In this case the 40 per cent rotation can be most profitable. For the 40 per cent rotation to be most profitable, however, more labor must be available than is optimum when feed cannot be purchased.

It appears that with price relationships as they are, the rotation that produces the most corn equivalent, thus allowing the farmer to feed the largest number of hogs from home-grown grains, is the most profitable rotation under most existing conditions. Only if

the price ration of pork and butterfat were to drop to something less than 15 would the rotations with the larger amounts of forage be the most profitable.
104 pages. \$1.30. MicA 55-1342

ECONOMICS, AGRICULTURAL

AN APPRAISAL OF THE EXPORT SUBSIDY PROGRAM ON BUTTER AND CHEESE IN FINLAND, 1933-39

(Publication No. 9752)

Risto Härmä, Ph.D.
Cornell University, 1954

This study deals with the effects on producers, taxpayers and consumers of the export subsidy program on butter and cheese in Finland in 1933-39. The specific objectives were as follows: (1) to determine whether or not the export subsidy program increased farm incomes more than the expenditure on subsidies; (2) to ascertain the cost of the program to taxpayers and consumers; and (3) to suggest alternative policies which might have been adopted in the same situation to improve farm incomes.

A brief examination of the reasons for adopting the export subsidy program indicates that it grew out of the farm distress of the early 1930's. This distress was caused by declines in forestry incomes of farmers and by falling prices of agricultural products including butter, cheese and fluid milk.

The export subsidy program on butter and cheese consisted of paying a certain amount of money per kilo of butter and cheese exported. Other measures designed to improve farm incomes also were adopted. These supplementary measures included prohibitive import duties on butter and cheese, restrictions on the use of butter and cheese substitutes (margarine and margarine cheese), limits on the use of imported feeds, import restrictions and mixing requirements on grain and export subsidies on eggs, pork and beef.

The analysis of the income-raising effect of the export subsidy program is based on the theory that subsidizing exports will increase the total revenue from any given output more than the expenditures on subsidies, provided the domestic demand is less price elastic than the export demand. The total revenue obtained from a given output also may exceed the expenditures on subsidies if the export demand is increasing (export demand curve shifting to the right) and the domestic demand is extremely price inelastic.

The available evidence indicates that the total revenue obtained by butter producers was greater as a result of the export subsidy program than it would have been in the absence of such a program. The additional revenue obtained exceeded the expenditure on butter subsidies.

The cost of the butter export subsidy program to taxpayers was relatively small. In an attempt to check

the growth of expenditures on subsidies, restrictions were imposed on the use of imported feeds; however, this failed to limit butter production and exports and hence was ineffective in holding down subsidy expenditures.

In no year did the subsidization of cheese exports raise farm incomes by an amount greater than the expenditure on subsidies. This result was due mainly to the high ratio of export to domestic sales.

The cost to taxpayers of the cheese subsidy program increased during the thirties but remained low relative to total government expenditures. The cost of the cheese subsidy program was borne mainly by high-income groups since they consumed the bulk of the cheese and contributed a large proportion of the tax revenue out of which subsidies were paid.

The butter and cheese subsidy programs did not contribute to the growth of efficiency in Finnish agriculture. Educational, land consolidation, credit and research programs are examples of the types of action which might have been taken to improve the long-run competitive position of Finnish dairy production. 156 pages. \$1.95. MicA 55-1343

THE ECONOMIC STRUCTURE OF AGRICULTURAL AREAS IN NEW YORK STATE

(Publication No. 9753)

William McDaniel Herr, Ph.D.
Cornell University, 1954

A generalized type of farming map for New York State was derived on the basis of the proportion of total productive man work units on each of six enterprises: dairy, forage, grain, poultry, fruit and vegetables.

Changes in types of farming by counties were indicated by calculating the distribution of work units on these six enterprises in 1934 and in 1949. Changes in types of farming tended to be consistent with the relative profits on these enterprises as measured by New York Cost Account Records.

While type of farming studies are justified primarily for their descriptive material, they are also useful in economic analysis. Two kinds of analysis were undertaken using type of farming areas as the geographic unit.

First, the economic structure was indicated by examining aggregative receipts and expenses on an area basis. When aggregative receipts (outputs) and expenses (inputs) are tabulated on an area basis, the consequence of changes in inputs, outputs or their prices on the net incomes of farmers in each area can be indicated. In areas which are predominately dairy about 60 percent of the gross output in 1949 was derived from the dairy enterprise. In predominately crop areas this proportion decreased to about 20 percent. The proportion of income from crops increased from 10 percent in the dairy areas to 45 percent of total gross output in the crop areas. Important differences between these two groups of areas

also were apparent with regard to components of total expenditures. The feed input was nearly twice as important in dairy areas as in crop areas. On the other hand, crop expenses were twice as important in the crop areas as in the dairy areas. Expenditures for labor increased from 13 percent in the dairy areas to 20 percent of all inputs in the crop areas.

From the above it is apparent that areas do not employ inputs in the same proportion or produce outputs in the same proportion. Changes in prices of these inputs and outputs will effect the net income of areas to a different extent. For example, when price of feed decreases, total production expenses in the intensive dairy area of New York are reduced more than are production expenses in other areas. Similarly, farmers in Western New York benefit more from a price support program on dry beans than do farmers in other areas of the state. With income and expense data arranged in tabular form, it is possible to determine the simultaneous effect of changes in many prices on the net profits of farms within an area.

Second, type of farming studies serve as a geographic base upon which problems of resource efficiency between areas can be examined. This analysis indicated that in New York State differences in average net income per worker were associated primarily with the typical size of farm businesses in each area rather than with differences of resources between areas. This suggests that area efficiency can be corrected by improving the efficiency of low production farms in areas in which they are concentrated rather than in shifting resources between areas. High concentration of low production farms occurred in four areas of the state: counties located along Lake Ontario, counties of the Southern Tier area, counties in the Central Lakes region, and counties in the mountain areas of the Adirondacks and Catskills. Improvement of efficiency on these low production farms can be made by combining farms, employing labor in non-agricultural jobs, and increasing the capital inputs in machinery, livestock, fertilizer, feed and such, relative to real estate. 271 pages. \$3.39. MicA 55-1344

ECONOMICS, COMMERCE — BUSINESS

WHOLESALE DISTRIBUTION OF MEAT AND MEAT PRODUCTS, WITH SPECIAL REFERENCE TO OMAHA, NEBRASKA, AS A MEAT PACKING CENTER

(Publication No. 12,164)

Rex Vance Call, Ph.D.
The Ohio State University, 1955

The Problem

The purpose of this study was to investigate the methods used in distributing meat and meat products in the Omaha, Nebraska, area, and to determine the

effect of technological improvements and of certain changes in marketing methods on meat distribution. Recent developments in commercial as well as in home refrigeration, modern practices of precutting and prepackaging meat in connection with self-service merchandising, and improvements in transportation facilities have all had an impact on channels of distribution and buying and selling policies of wholesalers, packers, and retailers. This situation calls for a re-examination of the wholesale distribution of meat products at this particular time.

Scope of the Study

Attention was directed to the wholesale distribution of meat in its fresh and frozen forms only – fresh or frozen beef, pork, lamb and mutton, and veal. This does not imply that there are no problems in the handling of canned meats, poultry, soaps and cleansers, and the many other products of the packers, but it was thought prudent to concentrate on this one area that can be dissociated rather clearly from the others.

This study was confined to the geographical area around Omaha, Nebraska, ordinarily referred to as the "normal wholesale area." Although many packers distribute nationally from their plants in and around Omaha, the interest here has been focused on their local wholesale sales as distinguished from sales made through branch houses and other outlets beyond the normal wholesale area.

Method

The method followed in this study was principally one of personal interviews with executives of packing houses and wholesale meat firms. Much valuable information was also received through correspondence with members of the meat industry trade association – the American Meat Institute – as well as members of the refrigeration and transportation industries' trade associations. Statistics of governmental agencies and other background material were secured from libraries.

Conclusions

The principal findings and conclusions indicated by the study are as follows:

1. There is an upward trend in the volume of precutting and packaging of meat in the Omaha area, but the impact has been small at the wholesale level. All fresh meat that is precut and packaged is processed at the retail level in self-service stores. Some sausage items and processed meats, but no fresh meats, are being precut and packaged by the packers.
2. Freezer food plans and frozen food lockers have had a negligible effect on the wholesaling of meat in this area. While there have been a number of freezer food plans in operation since World War II, they have all but disappeared. The use of frozen food lockers is static because of the increased use of home freezers and freezer sections of modern refrigerators.

3. Most meat marketed in this area finds its way to the consumer through the packer-retailer-consumer channel of distribution. Packing houses supply 90-95 per cent of the needs of retail stores and 25-35 per cent of the requirements of restaurants, hotels, and institutions. Merchant wholesalers are the principal suppliers of the restaurants because they offer such services as fabricating and daily delivery in small amounts.
4. The wholesale trading area of the Omaha meat industry is relatively the same today as it was when all meat products moved by rail, despite the increased speed and improvements in truck transportation.

248 pages. \$3.10. MicA 55-1345

THE DEVELOPMENT, INSTALLATION, AND MAINTENANCE OF EMPLOYEE PERFORMANCE EVALUATION PROCEDURES IN THE STATE SERVICE

(Publication No. 12,030)

William English Green, Ph.D.
The Ohio State University, 1954

Adviser: Ralph C. Davis

The Problem

This investigation deals with the evaluation of employees' contributions to the state governmental organization by which they are employed. It is concerned with the problems involved in the application of merit-rating principles and theories to a specific situation in state government. The basis of the report is the development and installation of a performance evaluation system in the state of Ohio. The forms and procedures reported are those used in the state for the year 1953 and the revised forms adopted for future use.

Procedure

The method followed in this study was to develop and install a merit-rating system in a state government. An effort was made to develop the best possible system for the specific organization and record the procedures followed. The system was developed through the cooperation of executives and officials of the state of Ohio. Those persons were members of a committee which accepted and examined the suggestions of all interested persons.

The preliminary investigations included a survey of existing merit-rating systems in similar organizations. An extensive search of literature was made for principles and procedures which had been used in other organizations, in both government and business.

Following this study and extensive discussions by the committee on merit-rating, twenty-four performance traits were included on a tentative rating form

to be tested in a pilot study. The pilot group of 228 employees under thirty-four supervisors was ranked in order of quality of performance by the supervisors. Raters were instructed to rank employees and turn rankings over to appointing officials of the departments. Two weeks later these supervisors were asked to rate the same employees on the tentative rating form. The rankings were tabulated and compared with the ratings on all items on the rating form. Only simple statistical procedures were used because of a distrust of statistical analysis felt by executives and officials. From the information obtained in this manner the rating committee decided on seventeen performance items to be included in the rating form.

An instruction manual was used along with classroom type training for instructing raters in the use of the rating form. Central class instructions were used to coordinate instructions in the various departments.

The ratings for the entire state service for the year 1953 were tabulated and studied for indications of needed changes in the rating form and procedures.

Conclusions

This study indicates that the following steps are of prime importance to the success of a merit-rating program in a state governmental organization.

1. Adequate development of the organizational structure with clearly defined lines of communication
2. Establishment of objectives for the rating system, with a definite relation of the program to the objectives of the organization at all levels of management
3. Adequate planning and staffing for the development and maintenance of the rating program

Where these functions are adequately carried out, existing merit-rating techniques, although lacking in accuracy, appear to offer a satisfactory means of evaluating employee performance. The greatest problem in state government seems to be a need for this basic planning rather than for more scientific accuracy in the rating process.

235 pages. \$2.94. MicA 55-1346

AN ANALYSIS OF CREDIT INSURANCE

(Publication No. 12,170)

Mark Richard Greene, Ph.D.
The Ohio State University, 1955

Credit insurance is a relatively unknown type of insurance coverage designed to protect manufacturers, wholesalers, and certain types of service organizations against excessive bad debt losses, i. e., those above a stated minimum amount. Despite its apparent significance, credit insurance has experienced slow growth in the United States, even though it has been sold continuously since 1890. This dissertation attempts (1) to determine the extent to which credit insurance has penetrated various

markets, (2) to explain the central reasons for the limited acceptance of credit insurance, (3) to suggest changes to increase its usefulness, and (4) to analyze the chief points of controversy surrounding the field.

To secure the facts necessary for the analysis a thorough study of credit insurance contracts was made. A review of court decisions interpreting these contracts was carried out. A study was made of home-office underwriting procedures of the American Credit Indemnity Company of New York, the only insurance company in the United States writing credit insurance exclusively. Analysis was made of policy records, loss experience, and other statistical records of this company. Interviews with underwriters, agents, and customers were undertaken. A review of literature in the area was included in the study.

The central argument for credit insurance is that this contract will protect the insured against excessive, unexpected, and unpredictable losses resulting from the insolvency of debtors. Proponents claim that the existence of the insurance has important psychological benefits in reducing fear of bad-debt losses, thus removing a hindrance to expanded sales. Advocates of credit insurance reason that it is illogical for a firm to insure inventory against loss arising from various perils only to ignore the possibility of loss when the inventory is sold and is in the form of accounts receivable.

The opponents of credit insurance counter the above points by arguing that the contract does not accomplish all that is claimed for it and that the insolvency peril can be met more satisfactorily through a bad debt loss reserve and through careful credit management procedures. Policy limitations and substantial deductions in the form of primary losses and coinsurance reduce the value of the protection. Conservative underwriting procedures further limit the usefulness of the policy.

Much of the analysis developed in this study points to the conclusion that credit insurance, as it is currently underwritten, is of limited usefulness in meeting the needs of the average firm. The following reasons are dominant in explaining the relatively small premium volume in this line: (1) the use of deductibles that appear to be large in proportion to the total losses suffered, (2) the complicated nature of the contract, (3) the competition of alternative means of meeting the insolvency peril, such as factoring or self-insurance, (4) the absence of concerted and effective sales effort in promoting credit insurance, and (5) conservative underwriting brought on partly by the lack of an actuarially sound rating structure and partly by the element of adverse selection of risks against the underwriters.

Credit insurance seems useful when a firm has a few large accounts the failure of any one of which would cause a severe and crippling loss. It is necessary that a careful analysis be made of the firm's exposure to loss and that the policy be written accordingly. It seems doubtful that credit insurance will become widely adopted unless improvements are effected to overcome at least some of the limitations noted above. 358 pages. \$4.48. Mic 55-127

**THE MISSISSIPPI SHIPPING COMPANY:
A CASE STUDY IN THE DEVELOPMENT OF
GULF COAST-SOUTH AMERICAN AND WEST
AFRICAN SHIPPING, 1919-1953**

(Publication No. 11,600)

Gilbert Myer Mellin, Ph.D.
University of Pittsburgh, 1955

In addition to its contribution to the annals of corporate experience, the history of the Mississippi Shipping Company, commonly known as the "Delta Line," affords an opportunity to investigate two important features in the economic development of the United States. First, the story of the growth of a shipping company engaged in the foreign commerce of this nation since 1919 is almost inevitably an account of the problems and experiences of the American merchant marine from that date. Secondly, the operations of the only American company offering liner service between the Gulf ports of the United States and the ports of Eastern South America and Western Africa reflects the nature of the trade relations which have been established between the areas served by those ports.

The numerous serious examinations of the American merchant fleet, and its various components, since World War I preclude any unique contribution in that field by this study. However, no comprehensive analysis has been made of the economic interrelationships and potentialities which exist between mid-continental United States and West Africa and Eastern South America. The patterns of Delta Line trade are utilized as a point of departure for the analysis of the evolution of commercial activities between these areas. At times the nonavailability or noncomparability of national or regional trade data is a source of statistical difficulty. Furthermore, only the barest beginning is made in assessing the possibilities for a more effective integration of the regional economies involved. Nevertheless, it is considered important that a start has been made.

For analytical purposes the time covered is divided into four periods. They are: (1) 1919 through 1929, (2) 1930 through 1940, (3) the World War II years: 1941 through 1945, and (4) 1946 through 1953. In each period the history of the Mississippi Shipping Company is preceded by quantitative and qualitative investigations of trade patterns and trends. Comparisons are effected by a series of narrowing frames of reference. The initial effort, in each case, is to ascertain the pattern of total United States foreign trade. In the next step the volume of United States commerce with each foreign area under consideration is compared with the total volume of United States international trade. Imports and exports are studied separately and composition of the cargoes carried is observed. Then Gulf trade and United States trade with each foreign area are contrasted. Following the demonstration of the relative importance of the Gulf in total United States trade with Eastern South America and Western Africa, the analysis shifts to a comparison of that segment of Gulf trade with total Gulf foreign commerce. The last step is to evaluate Delta

Line trade, by means of statistical and qualitative comparisons, with the appropriate sectors of Gulf and United States foreign trade.

This account of the growth and development of the Mississippi Shipping Company evidences that the intent of legislation designed to retain a share of United States foreign trade for ships flying the flag of this country has been successful for Trade Routes 20 and 14-2. It is also apparent that operations under a subsidy program do not relieve a company of the necessity for prudent business conduct. Shipping lines are extraordinarily sensitive to a host of economic and political influences. Since many of these influences are not amenable to control by any one firm, each company must be prepared to live within whatever environment is provided. Its future will depend upon the nature of the external situation as well as the soundness of its own policies.

454 pages. \$5.68. Mic 55-128

**A STUDY OF SUPERVISORY ATTITUDES IN
SELECTED LABOR MARKETS**

(Publication No. 11,426)

James H. Mullen, Ph.D.
University of Pennsylvania, 1955

Supervisor: Waldo E. Fisher

There has been a growing realization in recent years of the important role which industrial supervisors, particularly first-line supervisors play in industrial relations. As a result there has arisen a considerable literature on the nature of industrial supervision, supervisory problems, and supervisory development. Most of this literature has been based on observation, personal insights and experience. Comparatively little use has been made of attitude survey techniques.

The objective of this study has been to present the attitudes of industrial supervisors toward their job and job environment as well as toward selected economic issues. The method used was the attitude survey. While attitude surveys of industrial supervisors have been conducted previously, no published studies have included more than a few companies and none have embraced a single geographical region.

The data for this study were obtained from a sample of 1600 industrial supervisors in eleven labor markets in the United States. The supervisory sample represents a diversified group of industries, a cross section of age and salary classes, and small, medium and large companies. Approximately 50 per cent of this group were foremen, the remainder were general foremen, staff personnel, and other members of intermediate management. The survey results were computed on the basis of supervisory rank, age, earnings, seniority, education, and on the size, industrial classification and location of the company. An opportunity was afforded, therefore, to determine supervisory attitudes for each of these breakdowns.

The subject areas included in the first section of this survey are the supervisor's attitude toward his company, its management, its policies and personnel programs, as well as his job, his superior, his earnings and his role in industrial relations. A second section dealt with a number of economic issues of current interest. All data were obtained from written questionnaires. Supervisors were asked to answer 53 multiple-choice questions and expand their expressions of attitude by means of written comments.

SURVEY RESULTS

The survey results indicate a considerable diversity of thinking. The answers to questions which deal with the broader aspects of his job, show the supervisor to be loyal to his company, interested in his job, and reasonably satisfied with the fairness of his company's personnel policies. His answers to economic questions indicate satisfaction, for the most part, with our present economic order and belief that workers have received a fair share of the economic gains that have occurred over the years.

Underlying this over-all pattern of satisfaction, however, are important qualifications. The industrial supervisor's answers and comments point to a feeling of dissatisfaction with his status in the management organization.

- He frequently does not know which policies are applicable to particular situations.
- He is consulted only infrequently about policies and policy changes which affect him.
- He feels that his initiative and discretion in handling important management functions are restricted.
- He believes that his superior fails to keep him informed about his status and progress on the job.
- His performance frequently goes unrecognized.
- He often believes his pay to be inadequate, particularly in relation to the earnings of his subordinates.
- He is not sure that he really is a member of management. A large minority of the group were of the opinion that the best interests of foremen would be furthered by unionization.

The study also included an analysis of attitude survey methodology and the function of the attitude survey in industrial relations.

326 pages. \$4.08. MicA 55-1347

AN ANALYSIS OF RECENT STATE LABOR LEGISLATION

(Publication No. 12,115)

Leslie E. Munneke, Ph.D.
State University of Iowa, 1955

Chairman: Professor Walter L. Daykin

This study is based upon the following assumptions. First, it is assumed that the various states have had experience in the administration of labor policies which have not always been in accord with federal policy. Second, it is assumed that the various states have served as a proving ground for legislation, portions of which have been written into federal law. Third, the study assumes that an understanding of the various state labor relations laws may cast light upon the assumptions underlying the passage of labor legislation of the past, present and future. The fourth assumption is based upon the proposition that the experience of the states in dealing with their own labor problems may indicate where interference with laissez-faireism has reduced labor-management friction rather than increased it. Finally, it is assumed that an examination of the various state laws may indicate the direction future labor legislation may take.

In order to pursue the study, the following methodology was employed. First, a study was made of the historical development of labor-management disputes. Second, a study was made of the basic economic concepts involved in labor disputes as well as various suggestions advanced to solve the problems confronting labor, management and the general public. A third procedural step traced the historical development of labor legislation in the United States. Various tables and figures were used for the purpose of indicating the states having legislation covering selected aspects of labor disputes. Finally, an attempt was made to establish a relationship between the type of labor legislation in force in the various states with the per capita income of those states as well as an attempt to discover whether or not there existed a positive relationship between geographical areas, the type of labor legislation found in those areas and the per capita income of the various states.

The findings of the study may be summarized as follows. In the first place, it is to be noted that there has been a close relationship between federal and state labor legislation. Each jurisdiction has tended to influence the other. Secondly, labor unions have vigorously opposed the restrictive labor relations laws of some of the states on the grounds that they are biased in nature. The study discloses the fact that the administration of present day labor laws poses a difficult problem. This fact has not been conducive to industrial peace. Another finding of the study points to the fact that the possible effect of state labor law tends to vary. The empirical data of the study indicate that per capita income in the United States has steadily risen regardless of whether state labor law was protective or restrictive. Furthermore, the data of the study disclose a steady growth in union membership regardless of the type of labor legislation enacted.

The study does not indicate with clarity the effectiveness of state labor relations laws. While the trend in the number of work stoppages has been upward, there is no way of knowing what the strike record might have been in the absence of state laws. While it is true that the average duration of work stoppages has declined, it is difficult to determine whether this decline is attributable to state labor legislation or whether it is due to prevailing economic conditions. Finally, the conclusion may be reached that inasmuch as the trend has been in the direction of greater restriction of labor unions at the state level, these restrictive provisions may be included in future federal labor relations laws.

385 pages. \$4.81. MicA 55-1348

A SURVEY OF CURRENT PROVISIONS IN THE SENIORITY REGULATION OF SELECTED INDUSTRIES IN OHIO

(Publication No. 12,181)

Howard Clark Nudd, Ph.D.
The Ohio State University, 1955

Statement of the Problem.

Seniority has been defined, for the purposes of this study, as the principle of granting preference to employees in certain phases of employment in accordance with length of service. The principal aim of seniority is to afford the maximum security and reward to those who have rendered the longest service.

Seniority and security of employment are not always synonymous terms. Because factors such as economic conditions, government regulations, and new union proposals do affect the relative value of seniority to the employee, it is necessary to ascertain the seniority provisions in existence in order to predict and prepare for future developments. This study was made to determine the existing regulations and how such regulations are influenced by the size and location of the company, the type of industry, and the union affiliation.

Procedure.

This is a statistical analysis of 326 collective bargaining agreements of companies from fourteen selected industries of Ohio. The agreements were negotiated by unions affiliated with the American Federation of Labor, the Congress of Industrial Organizations and with independent union organizations. The agreements studied were in effect during the years of 1952 and 1953.

Results.

1. Probationary periods were found in over 93 per cent of the agreements. Only the stone, clay, and glass industries significantly deviated from this percentage.

2. The larger companies and those affiliated with the Congress of Industrial Organizations were more inclined to allow seniority to accumulate during a break in service, to spell out the methods of losing

seniority, and to allow for preferential seniority. These provisions were most prevalent in the fabricated metal products, the machinery (except electrical) and the electrical products industries.

3. The unit of application of seniority is based primarily on the size of the company. Adjustments may have to be made to the unit of application to protect long-service employees and highly skilled employees.

4. The majority of agreements based layoffs and promotions on seniority rather than ability. This was particularly true of layoffs. Only the chemical and the electrical machinery industries based promotions on ability in the majority of their agreements. It was noteworthy that independent unions based promotions, for the most part, on ability. Small companies were more inclined to base promotions, and less inclined to base layoffs, on ability than were large companies.

5. Significantly, the leather, stone, clay and glass, and transportation industries modified seniority by a work-sharing clause. Agreements made with unions affiliated with the Congress of Industrial Organizations permitted work-sharing to a greater extent than those with unions affiliated with the American Federation of Labor or with independent unions. Larger companies were more inclined to permit work-sharing than were smaller ones.

Conclusions.

1. For effective bargaining, management's honesty and sincerity must be known to be above reproach.

2. A probationary period of sufficient length to judge an employee's qualifications must be set up for each job falling under the seniority clause.

3. Methods of acquiring and reasons for losing seniority must be known and understood by the employees.

4. Clearly understood standards of performance and records for evaluating work done must be set up to minimize dissension concerning the relative competence of workers.

5. When possible, allow a cooperative sharing of responsibility for procedures by a joint committee of employer and union representatives.

6. Record accurately, and post, the length of service of each employee.

7. Develop a seniority plan with enough flexibility for deviations in the case of union officers or employees of superior skill and potential.

8. Limit the area of application of seniority to a size that will not result in constant shifting of employees during a layoff.

9. Record accurately all separations voiding seniority.

206 pages. \$2.58. MicA 55-1349

AN EVALUATION OF THE EFFECTIVENESS OF THE SERVICES OF THE COLLEGIATE BUSINESS PLACEMENT BUREAU

(Publication No. 12,118)

Bernard Dean Perkins, Ph.D.
State University of Iowa, 1955

Chairman: Professor Walter L. Daykin

The collegiate business placement bureau is a new-comer in institutions of higher learning. The first real impetus toward the development of organized placement services came in the 1930's when graduates were experiencing especially serious difficulty in finding employment. After World War II placement offices grew rapidly, largely because of the large influx of veterans into colleges and universities and the pressure of industrial personnel recruiters.

Purpose

The purpose of this study was as follows:

1. To discover the factors involved in evaluating the services of the college placement office.
2. To reveal those policies and procedures that make the greatest contribution toward effective placement.
3. To provide a possible basis for an evaluation of the placement office.
4. To furnish a foundation for possible revision of existing procedures and practices.

Plan of the Study

Five methods of procedure were used in making the study: (1) the use of questionnaires; (2) personal interviews; (3) examination of placement office forms; (4) visitation of placement offices; and (5) case studies of college graduates.

A three page questionnaire was constructed and mailed to three groups: (1) college placement directors; (2) industry recruiters; and (3) college administrators. Since the Midwest College Placement Association endorsed the project the questionnaire was mailed to the membership of that organization. This membership represented the first two groups listed above. Since the study was concerned with placement bureaus for schools of business administration, the questionnaire was mailed to the membership of the American Association of Collegiate Schools of Business. Placement directors responded with a 97.7 per cent return. Industry recruiters responded with a 96.2 per cent return. An 86.3 per cent return was received from college administrators. The overall response was 94.9 per cent.

Findings

Major factors involved in the evaluation of a placement service are: (1) objectives, (2) placement practices, and (3) occupational information.

Other factors to consider in an evaluation of a placement office are: (1) locating vacancies, (2) budget, (3) publicity, (4) location of the office, (5) college responsibilities, and (7) other items, such as leadership of the director and general economic conditions.

A slightly greater emphasis upon the student-centered philosophy of placement as opposed to the employer-centered concept appears to be the most desirable policy to follow in placement work. Procedures that deal directly with the registrant or industry recruiter appear to make the greatest contribution toward effective placement. Occupational information, counseling interviews, adequate personnel files, and leadership of the director make maximum contributions to effective placement.

Chapter VI of the study presents a check list for the evaluation of a placement office. This evaluation can be accomplished by local college authorities.

Chapter VII of the study presents some improved services for college placement offices. These include company information sheets, uniform personal data sheets, occupational information suggestions, vocational counsel suggestions, designation of certain tests to be used, improved reference rating forms, services for drop-outs and alumni, and the recommendation that senior students take a special course entitled *Business Careers*. 276 pages. \$3.45. MicA 55-1350

A RECONSIDERATION OF THE PERSONAL SELLING FUNCTION IN RETAIL ESTABLISHMENTS

(Publication No. 12,193)

Stanley Lewis Sokolik, Ph.D.
The Ohio State University, 1955

The selling function is of major importance in retail establishments. The radical changes in the performance of this fundamental function which have been a result of selling simplification justify the interest and attention of practitioners and students of business. The effects are evident in every segment of retailing as well as in the marketing activity of many manufacturers and wholesaling companies.

It has been the primary purpose of this study to develop a coordinated body of reliable and useful knowledge regarding the process of selling simplification and its effects on the personal selling function in all types of stores. Because of inadequacies of existing terms and lack of terminology, particular consideration has been given to definitions of major facets of simplified selling operation.

"Selling simplification" is defined as the specialized process of planning and controlling integrated selling situations in order to facilitate greater participation by the customer and to make more effective any participation by selling personnel. This process is best viewed as a store-wide merchandising concept, to be undertaken as a part of an integrated merchandising program. The primary concern is with the nature of the operational relationship between the factors (i.e., the customer and six major selling forces) involved in a sales transaction and evidenced in a "composite selling situation."

"Simplified selling" is identified with the resulting effects upon the totality of the selling performance

throughout a store, i.e., the objective or consequence of selling simplification. Personal salesmanship will not always be minimized or eliminated; improved salespeople may result. Four distinct kinds of selling can take place: unconscious/undefined want buying, pre-decision, pre-selection, and self-selection. Since there can be no simplified selling when buying patterns desired by customers are not properly encouraged and facilitated, the major emphasis should be upon how most customers want to buy.

In the field investigations emphasized in this research, the following lines of trade were included: department, limited-price variety, drug, hardware, and apparel specialty stores and food supermarkets. Interviews were held with line and staff personnel directly concerned with the problem in a limited but representative number of retailing companies. In-store observations of simplified selling in establishments of these and other companies were made also, and in some it was possible to analyze company records and management guides. In addition, existing literature about this retailing development and the theory and practice of retail personal salesmanship was thoroughly analyzed.

A body of principles has been derived through this theoretical and empirical investigation of selling simplification. The following are representative:

Because of a number of strong and continuing influences, in terms both of pressures for change in retailing and benefits which can be realized from sound selling simplification, current efforts to simplify the retail selling function and growing customer acceptance of the consequences represent part of a permanent trend in retailing.

So long as there are limitations in the employment of non-personal selling means and inherent advantages in the use of personal salesmanship which can be exploited through sound selling simplification, traditional sales-people will not disappear from the retailing scene.

Since retail selling simplification can result in fundamental and widespread effects upon many, if not all, phases of store operation; since it is a process which must be applied on a continuing basis to distinct sales situations; and since it requires careful coordination of the personal factors within a situation, a planned and integrated approach to the use of this process must involve the participation of top management, definite organizational responsibility in those who are directly concerned with selling activity, and an educational program for personnel and customers.

339 pages. \$4.24. Mic 55-129

ECONOMICS, FINANCE

THE EFFECT OF CHANGING PRICE LEVELS ON ACCOUNTING WITH SPECIAL REFERENCE TO AN AUTOMOTIVE COMPANY

(Publication No. 12,037)

Warren Asquith Howe, Ph.D.
The Ohio State University, 1954

Adviser: Hermann C. Miller

This study was conducted in an effort to answer three questions: First, what is the effect of changing price levels on accounting records? Second, how significant is the effect of the change in price levels on accounting records? Third, what, if anything, should be done about it?

An automotive manufacturing company was used as the subject of the study. The company records for the fourteen year period 1939-1952, inclusive, were reviewed. Comparative balance sheets and profit and loss statements showing the reported amounts and the adjusted amounts were prepared for these years. Supporting schedules, as needed, were prepared.

The retail price index for all commodities, prepared by the U. S. Department of Commerce, was used in making the conversions to 1935-39 values.

All accounts were adjusted to these values; then, for purposes of comparison, a conversion was made to 1952 values.

The relationship of certain important accounts was determined in terms of ratios, both on the reported figures and on the adjusted values. Herein is the unique feature of this analysis. Many studies have been made in which a partial conversion of amounts has been made. Ralph C. Jones and the American Accounting Association have made a complete conversion of amounts. This however, does not present the entire picture.

A much fuller interpretation of the effects of inflation can be obtained when the amounts and ratios are considered on both the reported and adjusted bases, as was done in this study.

The conversions revealed that, in many cases, the difference between the reported and the adjusted amounts was greater than the adjusted amounts themselves. On the surface, this seems very alarming. However, the ratios indicated that all accounts were influenced to a greater or lesser degree by inflation, so that the differences between the reported and adjusted ratios do not indicate the great divergence that one might expect. In other words, when both sides of the accounting equation are divided by similar rates of inflation, the resulting ratio is similar to that developed from the reported figures.

After careful study and a thorough analysis, the writer drew some conclusions concerning the effects of inflation on the accounting records of the company under study and made some recommendations.

The effect that changing price levels had on the accounting records of the company was that amounts were greatly overstated in terms of the base values.

However, because inflation has affected both sides of the accounting equation, the ratios as computed on the reported and the adjusted bases are quite similar.

The significance of this can be determined only after the complete picture has been studied. The impact of the great differences in amounts was offset, to a degree, by the ratios which were closely correlated.

Concerning what should be done about it, the writer is of the opinion that accounting records should be prepared in the traditional method using historical cost and supplemented by statements showing the effects of price level changes by adjustments through the use of proper index numbers.

As yet, there has been no universally accepted method for converting accounts to a stabilized value. Until such measures become standardized, there are too many arbitrary elements involved to justify the substitution of these supplementary statements for the traditional reports. If present trends continue, or if there should be a sudden, sharp increase in the price levels, it might be necessary for this country to adapt its accounting methods to these changes. But, in the opinion of this writer, that time has not yet come.

208 pages. \$2.60. MicA 55-1351

THE ROLE OF THE BANK OF JAPAN IN THE
ADMINISTRATION OF THE ECONOMIC AND
FINANCIAL CONTROLS OF THE
GOVERNMENT DURING NATIONAL
EMERGENCIES - WITH SPECIAL EMPHASIS
ON THE SINO-JAPANESE WAR AND THE
WORLD WAR II PERIODS

(Publication No. 12,072)

George Mazumi Taoka, Ph.D.
Columbia University, 1955

With its establishment in October 1882, the Bank of Japan provided the nation with a central financial institution for the first time. Its services as the sole bank of issue, fiscal agent of the government, and the institution of last resort during national emergencies aided the orderly development of the nation's economy. However, the Bank of Japan did not serve as a bankers' bank in the western sense of the word. The relative independence of the commercial banks, except during periods of extreme emergencies, limited the central bank's control over the money market. Furthermore, since commercial banks were not required to maintain reserves with the central bank, the Bank of Japan had little control over the credit policies of such institutions. Also, in following rather than leading the market rates of interest, the central bank's influence over the interest rates was weakened considerably.

In spite of these shortcomings, the operations of the Bank of Japan were indispensable during the various crises faced by the nation. However, each succeeding emergency found the central bank falling increasingly under the domination of the government. Prior to the China War period the Bank of Japan was relatively free

to determine its own policies; however, between 1937 and 1941, its policies began to be determined to a great extent by the government. By the second year of World War II, the nation's financial structure was brought under the supervision of the Ministry of Finance which not only exercised direct controls over the operations, but also conducted financial operations in the market through the central bank. The objectives of the government were paramount, and the central bank was not permitted to adopt policies that might interfere with the government's fiscal program. Its function was thus reduced to that of administering the economic and financial controls of the government.

Even after considering the fact that it was under the direct influence of the government, the Bank of Japan did not effectively use the tools under its command to fulfill one of the major objectives for which it was established - economic stability. This was especially true during the China War and World War II periods. Its open market operations were not conducted for the purpose of reducing the surplus funds in the money market during periods of inflation nor adding to the money supply during periods of stringency. Until the final months of World War II, it made no attempt to limit the use of its credit facilities to only those banks directly engaged in financing the war industries. It permitted the differential between its discount rates and the interest rates charged by commercial banks to remain in the face of currency and price inflation. If the Bank of Japan had taken a more positive action in these directions at the first indication that inflation was getting out of hand, the vicious circle of rising costs, rising prices, and rising wages might have been forestalled, and the country might not have been faced with the runaway inflation in the final months of the war.

There is no doubt that the Bank of Japan successfully administered the economic and financial controls of the government, especially during the war crises between 1937 and 1945. However, in serving in this capacity, it sacrificed the major objectives for which it was established. 251 pages. \$3.14. Mic 55-130

ECONOMICS, HISTORY

CHARLES BABBAGE - HIS LIFE AND WORKS IN THE HISTORICAL EVOLUTION OF MANAGEMENT CONCEPTS

(Publication No. 12,035)

John Hardie Hoagland, Ph.D.
The Ohio State University, 1954

Adviser: Ralph C. Davis

The objective of this dissertation is to evaluate the contributions made by Charles Babbage to the historical development of industrial management concepts. From material available in libraries in the United States the unusual life and great variety of works of

Charles Babbage were studied; the background of his management concepts was analyzed and his influence on later management developments was indicated. As a result of this research new information was presented on Babbage's works and contributions. Also, gross errors were found in the present interpretations of management history.

Charles Babbage was a leader of ideas and made contributions to such areas as statistics, calculus, life insurance, calculating machines, religion, light-houses, logarithms, scientific societies, and manufacturing. In 1832, when he wrote *On the Economy of Machinery and Manufactures*, he was already internationally recognized as a leading British scientist and a prominent figure in London society.

Calculating machines were Babbage's main interest and the motivation behind many of his activities. Although he spent a fortune on them, he never succeeded in completing one. Babbage had deficiencies of personality which limited his success and caused his reputation to decline until he was the laughing stock of many when he died in 1871.

Only a small portion of Babbage's time and energies were spent on writings which contained management concepts, but what he did produce were significant. Most of these appeared in his popular book, *On the Economy of Machinery and Manufactures*, but other writings did contain ideas on the science of shoveling, tooling, and a fair day's wage for a fair day's work.

On the Economy of Machinery and Manufactures was built around the earlier essay, "Introductory View of the Principles of Manufacturing." Both were largely based on the writings of others and were influenced by many people and circumstances, especially John Herschel and Baron Charles Dupin. Although this book contained few new facts, it was a contribution to management literature for it collected ideas from many areas and presented them in a more usable and understandable manner than had previous writings.

Babbage's influence did not die out, as previous management historians have believed, but continued to be favorably noted throughout the nineteenth century. Furthermore, he had a definite influence on twentieth century management developments, at least through the work of Frank B. Gilbreth.

Management historians have believed that the foundations of management were laid at the end of the nineteenth century, no significant work having been done prior to that date. This dissertation found this to be contrary to fact, for many significant studies of management problems were made even prior to Babbage. The evidence shows that many thousands of persons were actively engaged in the application of scientific principles to industry long before the advent of "scientific management." Furthermore, the evidence indicates that F. W. Taylor was not highly original in his work but probably plagiarized ideas from earlier studies.

This dissertation found that management historians have made gross errors in interpreting the true historical growth of management concepts.

424 pages. \$5.30. MicA 55-1352

ECONOMICS, THEORY

A REFORMULATION OF SOME ASPECTS OF WELFARE ECONOMICS

(Publication No. 11,936)

Seymour Kalb, Ph.D.
New York University, 1954

Adviser: Professor Otto H. Ehrlich

The objective of this dissertation is the reformulation of the sociological (interpersonal) aspects of welfare economics.

The investigation begins with A. C. Pigou's approach to economic welfare as a problem. Pigou theorizes within the frame of reference of economic theme: The concept of welfare is limited by definition, discussion proceeds on the level of aggregates, and value judgments are employed at critical points. It is argued that this three-fold pattern excludes the sociological aspects.

Lionel Robbins's discussion of the precise nature of economic theory as a frame of reference permits the discrimination between economic theory and sociological theory. Economic theory conceptualizes the relationship between man and economic goods, whereas sociological theory conceptualizes the relationship between man and man. The discussion of J. M. Keynes's *General Theory* argues that Keynes's modification of classical economics involves the addition of the element "involuntary action," a sociological category, to economic theory.

The main argument proceeds with the analysis of the Kaldor-Hicks-Scitovsky compensation principle, the concept consumers' surplus, and the Bergson-Samuelson social welfare function. It is argued that the compensation principle does not exclude interpersonal comparisons and is therefore inadequate as a criterion of an increase in welfare. The social welfare function is accepted as formally correct, but the question is raised as to whether welfare economics should be restricted to this approach. Each of the theories discussed is regarded as a variation on a theme; the formulation of the sociological element.

There are theories, however, which point in the direction of a socioeconomic conceptualization for the problem of economic welfare. Their most recent writings, of A. C. Pigou, D. H. Robertson and others refuse to be bound by Robbins's proscription of interpersonal comparisons. Of greater interest are the recent works of K. Arrow and W. J. Baumol. Via different frames of reference each arrives at the conclusion that the problem of economic welfare involves sociological elements. Arrow does not attempt a detailed socio-economic formulation. Baumol does, but this is regarded as a first approximation.

The development of a socio-economic frame of reference which is regarded as the original contribution of this dissertation builds on the publications of T. Parsons and E. Shils. The first step is the straight forward presentation of their systematic conceptualization of the social system with particular reference to Parsons's, *The Social System*. The

second is the modification of the Parsonian paradigm of interaction and institutionalization by the addition of the "content" of individual interests. This is the key to the formulation of the socio-economic frame of reference.

The positive presentation begins with a reconsideration of the definition of an economic exchange in terms of the sociological frame of reference. Traditionally, the voluntary aspects are conceptualized and the institutional elements assumed constant. The socio-economic definition includes the involuntary. An exchange is defined as generating a product dependent on the content of the interests of interacting individuals. The terms of settlement which determine the division of

this product are imposed by the value patterns governing the exchange. Since the socio-economic frame of reference precludes the definition of welfare as an aggregate, it is defined on the individual level. Individual welfare is defined as personality adjustment, which is in turn dependent on the difference between individual expectations and individual achievement. Economic welfare involves the economic influences on this balance.

The dissertation concludes with a reconciliation of the differences in previous economic welfare formulations in terms of the socio-economic frame of reference. 151 pages. \$1.89. MicA 55-1353

EDUCATION

EDUCATION, GENERAL

THE RELATIONSHIP BETWEEN RESEARCH IN READING AND CHANGES IN METHODS AND MATERIALS FOR READING INSTRUCTION, 1900-1950

(Publication No. 11,257)

Anna Barbara Carlin, Ph.D.
University of Michigan, 1955

The problem. - This study is concerned with a threefold purpose: (1) to assess the extent to which recommendations for selected instructional procedures in reading reflect the findings of research between 1900 and 1950, (2) to evaluate critically the influence of research on procedures and materials, and (3) to provide a systematic, historical background for understanding present-day practices in reading.

Sources of data. - The principal sources of data include: (a) accounts of scientific investigations in reading, (b) textbooks and teaching manuals for basal reading series, (c) curriculum guides and courses of study in reading, (d) surveys of public schools, (e) reports of school superintendents and boards of education, (f) reports of research bureaus for public schools, and (g) materials of instruction.

Procedure. - Six definite trends in the development of reading methods are considered in relation to research which appears to have influenced these trends, and a critical evaluation of practical results is given for each trend. Since the vast number of research studies precludes detailed consideration of all findings, the investigation is limited to significant and dependable research related to these trends. Considerable historical material is introduced in order to provide perspective for the interpretation of current practices in the light of their development.

Summary of findings. - The investigation of six trends in the development of reading methods gives

evidence of the influence of research as reflected in recommendations for: (1) wide use of the word and larger units of perception as the approach to beginning reading, (2) emphasis on developing efficient eye-movements, (3) emphasis on efficient silent reading, (4) emphasis on diversified reading instruction, (5) wide use of ability grouping and attempts to individualize instruction in reading, (6) reading readiness programs and administrative adjustments to provide for delayed reading groups, (7) simplification of vocabulary in primary readers, and (8) an increase in types of instructional materials for reading.

Conclusions. - 1. Emphasis on the purpose and place of reading as a school subject has changed fundamentally as a result of research findings.

2. The influence of research on recommendations for practice at the level of textbooks, courses of study, surveys, and school reports has been direct and immediate.

3. Research findings have supplied a psychological basis for the use of the word and larger language units as the approach to beginning reading.

4. Research findings have supplied a psychological basis for practicing diversified reading instruction.

5. Historically, two sources have converged in bringing about the widespread acceptance of the reading readiness concept - the contributions of research in mental measurement, and the contributions of research in child study.

6. The trend toward simplification of vocabulary in primary readers has been brought about through research in the field of vocabulary.

7. Reading materials have increased in amount to include more factual content, more accessory material, worktype readers, pre-primers, and readiness readers as a result of research.

285 pages. \$3.56. MicA 55-1354

AN EVALUATION OF CERTAIN COURSE
CONTENT IN RELATION TO UNDERSTANDING
OF PRINCIPLES IN A BIOLOGICAL
SCIENCE COURSE

(Publication No. 12,140)

James McFarland Elliott, Ed.D.
Michigan State University, 1953

The purpose of this study was (1) to obtain an evaluation of the content of the Biological Science Lecture Syllabus in relation to an understanding of principles presented in the course and (2) to derive from these data certain inferences and generalizations having implications for a) the objectives of Biological Science, b) the "minimum essentials" concept as it relates to Biological Science, c) the revision of the Biological Science Lecture Syllabus and the Study Guide for Biological Science, d) the examination program in Biological Science, and e) the preparation of laboratory studies in Biological Science.

A five-place rating scale was employed in obtaining the evaluation of syllabus content. The staff of the Department of Biological Science served as the "jury of expert respondents." The arithmetic mean of the ratings which each item received was calculated and assigned to the item as an index value indicating the degree of contribution toward an understanding of the related principle. The items related to each principle were arranged in a frequency distribution on the basis of index values. Reliability of the rating instrument was determined by the retake method. The product-moment coefficient of correlation between the two sets of mean scores for the units of the rating scale marked a second time were .86 and .75. The t-test revealed both coefficients of correlation to be significant at the 1 per cent level of confidence.

Based upon an analysis of the frequency distribution of items of syllabus content arranged in terms of index values, it was concluded that the syllabus contains information which contributes in varying degree toward an understanding of the principles presented in the study guide. Furthermore, the staff of the Department of Biological Science, acting collectively, was able to identify the elements of course content in the order of the importance of contribution toward an understanding of related principles.

The lecture syllabus does not treat adequately, by comparison, all of the principles presented in the study guide. Therefore, if equitable treatment of principles is a desired feature of the syllabus, the results of this study indicate areas where revision is needed and also provide information bearing on the general nature of the necessary changes.

The content of the syllabus does not adequately contribute toward attainment of the course objective "to acquire knowledge of some of the basic laws (principles) of biology" if it is assumed that this contribution must take the form of adequate contribution by syllabus content toward an understanding of the principles presented in the study guide.

Until a revision of course material is accomplished the evaluation of syllabus content obtained as a result of this study should be employed as a basis for the

investigation of the "minimum essentials" concept as it related to Biological Science and as a basis for the preparation of examinations and laboratory studies for use in the biological science course.

460 pages. \$5.75. MicA 55-1355

THE RELATIONSHIP OF READING ABILITIES
AND BASIC SKILLS OF THE ELEMENTARY
SCHOOL TO SUCCESS IN THE INTERPRETATION
OF THE CONTENT MATERIALS
IN THE HIGH SCHOOL

(Publication No. 11,984)

La Vern Laurel Krantz, Ph.D.
University of Minnesota, 1954

SUBJECT

The Relationship of Reading Abilities and Basic Skills of the Elementary School to Success in the Interpretation of the Content Materials in the High School

PURPOSE

To determine the relationships between measures of intelligence, reading and study skills as obtained in the seventh grade and achievement in certain content areas in grades nine and eleven.

POPULATION

The data was obtained from the pupil permanent records of the Austin Public Schools.

PROCEDURE AND METHOD

The tests used were the California Non-verbal Intelligence, Iowa Every Pupil Tests of Basic Skills and the Iowa Educational Development Tests.

CONCLUSIONS

All zero-order relationships among seventh grade reading abilities and study skills, as well as between seventh grade reading abilities and study skills and high school content areas, grades nine and eleven, were found to be statistically significant at the one per cent level.

The correlations were very high with zero-order r 's about as high as multiple R 's.

The verbal achievement tests such as reading vocabulary and reading comprehension, generally surpassed all others in predictive capacity.

There were some reading abilities and skills 'specific' to certain content areas which held their place in prediction to that area regardless of time span.

Predictions of high school achievements, as measured in the present study, were generally better when made from both reading and study skills than from study skills alone.

For the type of measurement used in this study there appeared to be little point in breaking down total study skills for purposes of prediction.

Predictions made from seventh to eleventh grade levels were about as accurate as were those from seventh to ninth grade levels.

Reading vocabulary was more closely related to all content areas on the ninth grade level than any other measured ability.

Reading comprehension was more closely related to all content areas on the eleventh grade level than any other measured ability.

Use of the dictionary was found related to the same areas of content on both the ninth grade level and the eleventh grade level.

Total study skills, reading comprehension, and reading vocabulary predicted with greatest frequency to both ninth and eleventh grade levels.

Group skills predicting ninth grade and eleventh grade content areas showed different patterns for all areas except that of ability to interpret literary materials.

When the study skills were considered as independent predictors, use of dictionary and reading graphs, charts, and tables were found the most persistent, and appeared in the greatest number of predictions to both ninth and eleventh grade levels.

The 'high specificity' outlook needs further qualification by reason of the fact that the combinations of measures yielding predictions over the two and four year spans did not always remain constant.

The amount of contribution by each reading ability and study skill varied with the content area predicted.

Achievements in the high school content areas at ninth and eleventh grade levels were predicted with high accuracy from measures of reading and study skills at seventh grade levels.

A low degree of ability to predict success in natural science indicated a weakness in measurement pertinent to this area.

The study skills were found to be most highly related to the social studies area.

Total study skills did not predict reading in natural science.

The vocabulary test of the Iowa Basic Skills Battery, with one exception, the content of literary material, did not predict to any content area in the eleventh grade.

EDUCATIONAL IMPLICATIONS

Increased attention should be given to the teaching of reading in the materials of the content areas. Educators need to provide for teachers in training a depth of scholastic background commensurate with future instructional needs.

327 pages. \$4.09. MicA 55-1356

AN EXPLORATION OF THE EFFECTIVENESS OF DENOMINATIONAL INFLUENCE UPON STUDENTS OF A MISSION SCHOOL IN CUBA

(Publication No. 12,091)

William Hendy Shephard, Ed.D.
University of Maryland, 1955

Supervisor: Gladys A. Wiggin

The problem of this study is to ascertain whether attendance at the Colegio Adventista de las Antillas, Santa Clara, Cuba, influenced the students toward behavioral characteristics and religious concepts which are peculiar to this Seventh-day Adventist school environment, and to determine the persistency of these characteristics and concepts upon the students after they have returned to their home environments.

Eighty-six presently enrolled and seventy-three previously enrolled students provided responses to twenty-one questions on behavior before, during, and after school attendance in six areas: health, religious ethics, school program, religious concepts and beliefs, social practices and recreation. The responses were obtained by personal, conversational interview. They were categorized according to family background, length of school attendance, and age at time of school attendance of students. Behavioral changes due to school attendance were tested for significance by the chi-square technique.

Findings in terms of statistical significance are the following:

Health. The influence of the school is ineffectual in respect to vegetarianism, use of tobacco and alcohol, and habits of personal cleanliness.

Religious ethics and customs. The influence is ineffectual on use of make-up, jewelry, profanity, and force in settling disputes.

School program. There is an effective influence which promotes free discussion of personal and other problems and participation in community activities; the influence is ineffectual on the question of the dignity of labor.

Religious concepts and beliefs. There is an effective influence for belief in the infallibility of the Bible and the priesthood of Christ; the influence is ineffectual on other religious beliefs.

Social practice. The influence is ineffectual on questions of equality in marriage, the importance of the individual, and the moral standard of the Ten Commandments.

Recreation. The influence is ineffectual in regard to improper places of amusement, participation in missionary activities, and regular exercise.

Study of behavior during attendance. There is an effective influence which induces the students with social and civic amenities in preparation for responsible citizenship; the influence is less effective presently than previously on religious concepts and beliefs.

The greatest behavior changes are made by the older students and by those with longer attendance records. The areas of greatest change are on questions of (1) the infallibility of the Bible, (2) the priesthood

of Christ, (3) free discussion of problems, (4) participation in activities, (5) equality in marriage, and (6) the importance of the individual. The areas of least change are (1) tithing, (2) manual labor, (3) concept of prophecy, (4) use of artificial make-up and jewelry, and (5) use of tobacco and/or alcohol.

The technique used was fruitful for this particular study and may be profitable where outcomes of a school program are to be evaluated. Further investigations might well determine what effects the type of community, social status and length of time out of school might have upon the responses. A corresponding study of a similar school in the United States as well as one in the eastern hemisphere, where the American influence is not so definitely felt, would add desirable information. 197 pages. \$2.46. MicA 55-1357

**A STUDY OF SOME DIFFERENCES IN
BACKGROUND, ATTITUDES, EXPERIENCE,
AND PROFESSIONAL PREPARATION OF
SELECTED ELEMENTARY TEACHERS
WITH CONTRASTING LOCAL SUCCESS RECORDS**

(Publication No. 11,209)

Roy S. Steinbrook, Ed.D.
Indiana University, 1954

The Problem

The purpose of this study was to determine and analyze the characteristic differences in resources, experience, attitudes, and professional preparation of elementary school teachers who had contrasting success records in a large city school system.

Procedure

In initiating the study, the complete cooperation of the administrative officers of the school system was obtained. In addition to accepting the responsibility for the selection of the teachers to be used, members of the administrative staff wrote letters to the teachers and principals requesting their cooperation and permitted use of their personnel folders. The investigator had requested that a group of 50 teachers be selected who were experiencing outstanding teaching success locally and a similar group of teachers considered least successful in the school system.

A questionnaire was constructed in order to collect information from the selected teachers regarding their personal and professional resources, attitudes, experience, and professional preparation. The questionnaire was revised after a limited pilot study and subsequently in terms of recommendations from the members of the elementary education staff of Indiana University. Then it was sent with a letter from the assistant superintendent, a letter from the investigator, and a self-addressed stamped envelope to each of the participants.

In an effort to strengthen the possibility that the questionnaire would be returned and for the purpose of validating, insofar as possible, the selection and classification of the participating personnel, a classroom visitation was made to each participant's classroom.

In addition to the information obtained through the use of the questionnaire, other data were gathered from the respondents' college records with respect to the type and extent of professional preparation experienced by the participating teachers.

Conclusions

Due to the characteristics of the sample used in this study, generalizations to a larger population undoubtedly must be accompanied by a reasonable degree of precaution. However, the findings seem to be sufficiently indicative to establish probable relationships between teaching effectiveness and some of the factors investigated through this study. Obviously, before rigidly conclusive statements can be made regarding these relationships, much further verification and study is required.

Within the aforementioned limitations of this study, however, the following conclusions may be drawn:

1. Experience appears to be associated with success in teaching.
2. Teaching successfully seems to depend upon a number of complex factors of which none is totally differentiating.
3. Student teaching experiences, at the elementary level, seem to contribute rather directly to teaching success.
4. The total amount of college work appears to contribute to teaching success but, in itself, does not offer assurance of such success.
5. Teaching effectiveness at the levels studied appears to be more closely related to types of professional preparation experienced by teachers than to the total number of college hours taken.
6. Recognized success in teaching appears to be related to more wholesome and constructive attitudes toward children and toward professional activities and responsibilities. Conversely, teachers who experience little success tend to be annoyed by a greater number of elements of the classroom situation and by more trivial aspects of child behavior.
7. The proportion of college preparation devoted to professional courses in education and educational methodology appears to be a contributing factor in successful teaching at the elementary school levels.
8. Successful teachers have a greater tendency to affiliate with professional organizations and to participate in in-service activities of the school.

205 pages. \$2.56. MicA 55-1358

EDUCATION, ADMINISTRATION

SCHOOL DISCIPLINE: EVOLUTION OF THEORY AND PRACTICE WITH A CRITICAL STUDY OF ATTITUDES OF A SPECIAL HIGH SCHOOL CLASS

(Publication No. 9737)

Leonard Cornelius Buyse, Ph.D.
Cornell University, 1954Purpose of the Study

This study was undertaken to provide school administrators and disciplinary officers with the following information: (1) a brief history of the development of current disciplinary theory and practice in this country, beginning with origins in the European schools and universities during the late medieval period, (2) a report of the attitudes expressed by members of the Ithaca High School Class of 1953 in regard to several aspects of discipline, (3) opinions of authorities on discipline, and (4) suggestions for developing and maintaining effective pupil control.

Methods of Research

The evolution of disciplinary practice was delineated through historical research. By means of a twenty-two question instrument the attitudes of this special class toward discipline were determined. Answers to the questions were presented in forty-six tables which showed responses in relation to misconduct status, truancy status, IQ, and achievement. Both the chi-square test and t-test were applied in the statistical analyses.

History of Discipline

The transition in methods of child rearing and pupil control over the past five centuries has involved the gradual change from the severe autocratic type of discipline to the current application of developmental psychology. Throughout this evolution there has been a gradual but persistent movement toward a freer discipline, a discipline respecting the individuality of the child and developing in each child the ability and desire to be responsible for his own actions in a free society.

Basic Disciplinary Principles Practiced in American Schools Today

1. Discipline can be taught effectively by setting a good example of self-control and emotional maturity.
2. The teacher should be kind but firm, showing respect for the pupils' feelings but disapproval of misbehavior.
3. It is wise for the teacher to let the pupils know that he appreciates how they feel. Pupils should be permitted to work off frustrations and the teacher should direct their emotions and feelings into acceptable activities.
4. It is good policy to use friendly guidance which promotes intelligent obedience rather than employ methods which insist upon blind submission.

5. The teacher should investigate the sources of disciplinary difficulties and avoid merely treating symptoms.

6. Disciplinary action should not be attempted when either the teacher or a misbehaving pupil is emotionally upset.

7. Accepted disciplinary methods should be used consistently by both parents and teachers.

8. The teacher should let the pupils know what is expected of them and how they are measuring up to expectations. Rules and limitations are necessary as they tend to provide security.

9. Pupils should be given responsibility commensurate with their ability to handle it.

10. As pupils mature and develop self-control, self-reliance, and self-direction, teacher control should be relinquished.

11. Bribing, threatening, and bargaining, should be avoided by the teacher.

12. The teacher should permit pupils to face conflicts and difficulties since pupil growth occurs through effective problem-solving.

13. In disciplinary situations the teacher should always ask himself this question: "Do my actions promote or hinder pupil social adjustment?"

14. The teacher should strive to create a pleasant school environment and should make the pupils feel that they are appreciated, trusted, and considered as individuals.

Major Conclusions Based on the Statistical Analyses of Survey Results

1. On the basis of t-test results no apparent relationship existed between intelligence and either the misconduct or truancy status of these seniors; but a definite relationship existed between achievement and both misconduct and truancy status.

2. There was a tendency on the part of misconduct and truancy cases to be dissatisfied with disciplinary procedures at their school.

3. Disciplinary policy at Ithaca High School was acceptable to three fourths of the group.

4. This class strongly favored giving a disciplinary case the benefit of counseling and another chance before employing more direct measures.

5. These seniors were reluctant to support a student court system.

6. A definite awareness of the relationship between school conduct and home training was indicated.

7. The group demonstrated a reasonably good understanding of the various aspects of school discipline and endorsed a disciplinary policy characterized by student self-control, good student-faculty relationships, elimination of the causes of misbehavior, and the employment of punishment which is considered fair by the students. 369 pages. \$4.61. MicA 55-1359

THE SELECTION AND ON-THE-JOB
PREPARATION OF ELEMENTARY SCHOOL
PRINCIPALS IN OHIO CITIES

(Publication No. 12,022)

Richard Lee Featherstone, Ph.D.
The Ohio State University, 1954

Adviser: R. F. Campbell

STATEMENT OF THE PROBLEM

The primary objectives of this study were three-fold: (1) to locate the various programs for the selection and on-the-job preparation of the elementary school principal in effect in Ohio cities, (2) to evaluate the existing programs in the light of criteria for such programs as recommended by teachers, professors, principals, and superintendents, and (3) to develop a guide relating to programs for the selection and on-the-job preparation of the elementary school principal which could be used by Ohio city superintendents to plan such programs.

METHODOLOGY

The data used in this study were gathered through the use of questionnaires and group rating scales. Initially, 135 Ohio city school superintendents were queried. A second questionnaire was sent to those superintendents who answered certain parts of the first questionnaire. A jury of professional persons was selected to appraise a set of criteria relating to selection and on-the-job preparation. The jury included thirty-seven elementary school principals, thirty-one professors of educational administration, eighteen school superintendents from Ohio cities, and forty-six teachers.

CONCLUSIONS

1. The major goal to be met through developing selection programs is to select more capable persons for the elementary school principalship.
2. There are almost no well-defined programs for the selection of candidates for the elementary school principalship in Ohio cities.
3. Ohio city school superintendents have widely differing opinions about what constitutes a formal program for the selection of candidates.
4. The size of a school system seems to have a limited effect on the development of policies with regard to the selection of candidates.
5. Candidates for the principalship in Ohio cities are selected on the subjective judgment of the superintendent, without the use of objective data other than college credentials.
6. The number of Ohio city school systems where advisory committees are being used in the selection of candidates is increasing.
7. There are only a few school systems where any written policies relating to selection are to be found.

8. The main objective of the on-the-job training program is to provide some supervised training for the beginning elementary school principal.
9. The majority of newly appointed elementary school principals in Ohio cities have no guided training while on the job.
10. Although a few on-the-job preparation programs are well defined with regard to general training experiences, little thought is given to a needed sequence of educational experiences.
11. The on-the-job training programs in Ohio cities are planned without taking into consideration desirable, coordinated university training.
12. The rapidity with which a school system is growing has some effect on the superintendent's thinking regarding the development of on-the-job training programs.
13. Evaluation of the trainee's work in the majority of the on-the-job training programs is centralized in the hands of the superintendent or immediate supervisor.
14. The few fairly well-defined on-the-job training programs in Ohio cities are planned by superintendents and follow the pattern of the original program developed at Akron circa 1935.
15. The trainees in the on-the-job preparation programs are considered to be on a probationary status until the completion of the program.

RECOMMENDATIONS

The recommendations are presented in the form of a guide for planning selection and on-the-job preparation programs. Major steps in the development of such programs are outlined. The role of the board of education, school staff personnel, and community members is suggested. Further suggestions are given for initiating and developing such programs. Included in these suggestions are guides relative to developing board policies affecting selection and preparation, defining the actual stages of selection and training, preparing criteria for selection, defining experiences required in the training program, providing for supervision and evaluation, and defining the role of university personnel and the function and nature of administrative arrangements.

301 pages. \$3.76. MicA 55-1360

AN IDENTIFICATION OF SUCCESS CRITERIA
IN EDUCATIONAL ADMINISTRATION

(Publication No. 12,026)

Walter Clayton Garland, Ph.D.
The Ohio State University, 1954

Adviser: R. F. Campbell

The problem. The impetus for this identification study of success factors in educational administration

came from the interest of the School-Community Development Study at The Ohio State University.

The study held to the purpose of finding a way to determine when, or under what circumstances, educational administration is successful. One of the basic assumptions was that competencies needed by educational administrators are generally similar, regardless of the administrative position in the hierarchy.

Procedures. The first major step consisted of the development of a theory of educational administration. The formulation of the theory was based upon emphasis from the literature and selected research in the field of educational administration.

From the encompassing statement of theory were drawn the principles which seemed to structure the theory. These became the success criteria, being nine in number. In order to make the criteria more objective in relation to the action level of educational administration, each criterion was described in terms of possible, or suggested, administrative behaviors.

As a limited check upon the validity and the practicability of the success criteria, a field survey of six administrators, representing three types of administrative positions, was undertaken. These administrators were selected by juries of professional educators who were acquainted with the administrative personnel. The selection panels ranked the administrators by quartiles. One subject for each type of position was chosen from each of the first and the fourth quartiles.

The major purpose and central emphasis of this dissertation was upon the formulation of the success criteria, not upon the field observations.

Findings of the study. The success criteria which were formulated are as follows:

1. Educational administration employs a creative approach to matters of educational concern.
2. Educational administration promotes and secures the professional growth of the people connected with and related to the educational enterprise.
3. Educational administration manifests high ability in the assessment of values, purposes, needs, and in their translation into realistic educational goals.
4. Educational administration exhibits skill in appraising the manner in which existing situational factors will affect the attainment of goals.
5. Educational administration establishes and maintains an appropriate climate which enables effective contributions by those involved.
6. Educational administration initiates and maintains procedures and structures which enable broader participation in the administrative process.
7. Educational administration secures an effective utilization of all available resources.
8. Educational administration envisions the totality of administration and integrates its component elements to secure established objectives.
9. Educational administration provides for systematic review of all phases of the educational venture and effects desirable reconstructions.

As a result of the limited field research it was concluded that the success criteria were usable and reasonably valid. On the assumption that positive evidence of the criteria behaviors denoted the successful administrator, the results of the criteria measurement were consistent with the selection panel's comparative ranking of the administrators who were observed.

Recommendations cited a number of implications for the field of educational administration and for institutional preparatory programs. Further research is recommended in the interest of devising a scale for the observer's check sheet which will make possible more differentiated measurements and better statistical treatment of the results.

238 pages. \$2.98. MicA 55-1361

A STUDY TO DETERMINE THE EFFECTIVENESS OF A PLANNED FILM PROGRAM IN SELECTED COUNTIES IN IOWA

(Publication No. 12,105)

Waldemar Gjerde, Ph.D.
State University of Iowa, 1955

Chairman: Professor James B. Stroud

The use of audio-visual teaching aids has become an established part of teaching procedures in our public schools. The use of these aids has assumed such proportions as to make the matter of their availability through proper distribution channels a serious problem. There has been considerable discussion in the state of Iowa as to the feasibility of establishing county film libraries. It is anticipated that such libraries should be responsible for securing, maintaining, and distributing these teaching materials free of charge to the local schools. Accordingly an investigation was carried out to compare the general effectiveness of a county system of this kind with prevailing practices, in which most local schools secure films on a rental basis from two centers within the state and from centers outside the state.

There was a secondary purpose of comparing two methods of selection. In two groups of experimental counties, films were placed at the disposal of county superintendents of schools free of charge for use with the teachers in their counties the semester in which the investigation was in progress. In one of these groups of counties films were selected by school administrators with or without consultation with teachers. In the other group of counties, committees of teachers themselves selected the films after study and consultation. In another group of counties, which served as a control group, films and teaching aids were secured in the usual way, from existing distribution centers, at the customary rental fees.

Thus the major purpose of the investigation was to compare a system of county film libraries, where films are provided free of charge to local schools,

with the present system of renting films from widely dispersed centers. A secondary purpose was to compare two methods of film selection for the county film libraries. In one case, the selections were made by the school administrators. In the other, selections were made by teachers after study and consultation. Comparisons of the three procedures were made on a number of issues, such as number of films used per teacher, the adequacy of films selected, the effectiveness of the utilization of films in teaching, teacher satisfaction with the films, and the securing of films at the time they were desired. It was anticipated that beneficial results in the way of greater teacher satisfaction and better utilization would accrue if teachers were given the responsibility for selecting the films.

The results of the investigation favor the decentralized plan of providing free films. They also favor teacher participation in selection of films. These two main conclusions are supported by such facts as the following: (1) that teachers under the experimental plan used many more films than those in the control group, (2) that better utilization was secured, (3) that booking problems were reduced, and (4) that teachers found it possible to preview films before using them; and by the fact that films of better quality and films covering a better range of subject matter were provided when the films for the libraries were selected by classroom teachers.

133 pages. \$1.66. MicA 55-1362

CURRENT PRACTICES IN PLANNING AND ACCOMPLISHING SCHOOL BUILDING PROGRAMS IN ALLEGHENY COUNTY

(Publication No. 11,589)

Charles Howard Hayes, Ed.D.
University of Pittsburgh, 1955

The purpose of this study is to identify areas that are particularly significant in the planning and accomplishing of a school building program and to determine the means of handling them which school administrators in Allegheny County have found to be most satisfactory. The procedures and techniques used in Allegheny County have been compared with those recommended by experts in the field.

All superintendents and supervising principals of school districts in Allegheny County which have engaged in building programs between January 1, 1950, and August 1, 1952, supplied the main source data by their replies to a questionnaire. Additional information was obtained from the office of the County Superintendent, Allegheny County, Pennsylvania. Material relating to expert opinion was obtained by a study of (a) recent research studies relating to school building problems; (b) related dissertations; (c) periodical literature that has been written within the past ten years; and (d) textbooks in the areas of school building, school administration, and school public relations.

The questionnaire used in this study was developed by means of a study of current literature relating to

school building problems. A group of superintendents and supervising principals who have had recent experience with school building programs suggested certain additions and revisions which were incorporated into the final questionnaire.

The principal findings of this study are presented in a list of 46 statements in regard to the most common conditions and procedures which have prevailed in Allegheny County in relation to school building programs.

The general conclusions derived from this study are the following:

1. Districts have not and are not anticipating school plant requirements far enough in advance of actual need.
2. About one-half of the school sites purchased are less than the minimum size recommended by authorities.
3. Although it is widely recommended that site selection be a part of city planning, most districts do not consult a city planning body prior to site purchase.
4. Many individuals and groups have been brought into the school plant planning process; however, the initiative and leadership still rest with the chief executive of the board.
5. In general, those methods of imparting information which involve direct, personal contact with the public have been found to be more successful than the more indirect and impersonal media of communication.
6. In most school districts there has been no active opposition to building programs. Service, civic, and parent-teacher groups will usually take an active part in supporting the program.
7. Experience with school building designing is the primary criterion used in the selection of an architect.
8. Cost of architectural fees in the district tend to be somewhat less than the eight per cent of building costs recommended by the American Institute of Architects.
9. School boards usually adhere to preferred practice in designating the chief executive of the board as liaison between the architect and the board.
10. Bond issues floated by a school district as compared to those issued in connection with a Local Authority generally (a) carry a slightly lower rate of interest; (b) are issued for shorter terms; (c) are more apt to be sold at public than at private sale; and (d) are less likely to contain a call feature.

240 pages. \$3.00. MicA 55-1363

**A STUDY OF POSSIBLE ECONOMIES THROUGH
CENTRALIZED PURCHASING OF SELECTED
TRANSPORTATION ITEMS FOR THE PUBLIC
SCHOOLS OF THE STATE OF WASHINGTON**

(Publication No. 12,134)

Ralph Kenneth O'Brien, Ed.D.
University of Washington, 1955

Supervisor: George D. Strayer, Jr.

This thesis had as its purpose that of determining some of the financial advantages or disadvantages which might occur through establishing a centralized purchasing program for selected items used in maintaining transportation facilities in the public school systems of the State of Washington.

Questionnaires were used to gather information from the school superintendents of the State of Washington and also from the head school officials of the other forty-seven states.

The State of Washington contract price was used as a basis of comparison for gasoline, batteries and tires purchased by the individual schools. In the case of gasoline, it was found that the reporting schools purchased gasoline at an average price of four tenths of a cent below the state contract price. Ninety-two per cent reported purchasing gasoline either on a school contract or on a country contract.

The comparison of cost of batteries purchased by the reporting schools was made with the cost of similar batteries at state contract price. If batteries had been purchased at the state contract price, the difference would have been 30.28 per cent of the total cost.

Those schools that purchased tires through the cooperative effort of a county school directors' purchasing groups received the most favorable price. If tires of the same size, ply and tread had been purchased at the state contract price, the difference in cost would have amounted to 21.32 per cent of the total amount paid by the schools.

The schools of the state reported the purchase of buses of thirteen different capacities. If all the schools reporting the purchase of buses had purchased at the cost of the lowest priced bus in the same capacity, the total school cost would have been \$146,136.07 below that cost reported paid by the schools. These figures, projected to cover the estimated number of buses purchased by the schools of the State, would have been \$229,918.30.

In surveying the methods used by other states to procure school buses, it was found that in seven states there was some form of state control over the amount a school could pay for a bus. In North Carolina, South Carolina and Texas the state purchased buses for the schools. In Mississippi, Oklahoma and Alabama the state established the maximum amount a school could pay for a bus and in Arkansas the state established the maximum amount a school could pay if money were to be borrowed to pay for the bus.

The specifications for school buses in all the above mentioned states were more lenient than were the specifications in Washington, and a bus of the same approximate body dimensions had a seating capacity

of eight more than the same bus would have had in Washington.

If buses of equal capacity, with the above adjustment, could have been purchased by Washington schools at the North Carolina price schedule the difference would have been 44.45 per cent of the Washington price. The same comparisons for other states follow: South Carolina - 49.25 percent; Texas - 48.59 percent; Arkansas - 30.85 percent; Mississippi - 32.51 percent; Oklahoma - 8.73 percent.

It was recommended that schools be encouraged to purchase gasoline on county contracts and that it be made possible for schools to purchase batteries and tires on the state contract. The Washington State Legislature should make it possible for the State Superintendent of Public Instruction to establish maximum prices for school bus bodies and chassis allowed for a school to be reimbursed from the state transportation fund. 311 pages. \$3.89. MicA 55-1364

**THE JOB OF THE HIGH SCHOOL PRINCIPAL
AS PERCEIVED BY CALIFORNIA CITY
SUPERINTENDENTS**

(Publication No. 12,255)

Thomas W. Walters, Ed.D.
Stanford University, 1955

In California, the recent rapid expansion of the responsibilities of education and the increase of school populations, have, among other consequences, made the high school principalship a more complex role.

While there have been numerous articles and comments from individuals and groups of observers concerning the duties and responsibilities of the high school principal, criteria for choosing and evaluating this administrator is vague and limited.

The Problem

This study is an attempt to identify some areas of high school principal behavior which, in the judgment of city superintendents in California, are the most crucial in determining success or failure in that administrative role. Its purpose is to discover and analyze the superintendents' perceptions of criteria considered significantly critical in one's carrying out the functions of the role of high school principal. The writer recognizes the existence of other reference groups but because of the growth of responsibility, and the strategic position of the superintendent's office in regard to the functions of choosing principals and supervising their work, it seems evident that whatever source of evaluative data one prefers, an awareness of the superintendent's viewpoint is of crucial import.

The Procedure

A pattern of approach, the critical incident technique, originated and extensively employed by John C. Flanagan of the University of Pittsburgh, was chosen as a preliminary data securing instrument.

The technique involves the reporting of on-the-job incidents, judged by qualified observers to be critical in the sense that they significantly contributed to success or failure.

The original panel of observers for this study were 25 city superintendents in the Los Angeles and San Francisco metropolitan areas, who were interviewed for the purpose of securing descriptions of most and least effective and ineffective principal behavior. From these reports, descriptive statements of high school principal behavior were formulated, printed on two check lists, and submitted to all California City superintendents for their evaluation. Ninety percent responded.

Those behaviors which received more than chance support, as determined by the arc-sine transformation,¹ were presented in the dissertation on four tables, which identified them as: most critical effective, least critical effective, most critical ineffective, and least critical ineffective. These were analyzed, singly and in opposition to others, for what might be inferred to be dominant superintendent perceptions of critical principal behavior.

Conclusions

1. A highly consistent pattern of response was revealed in that five of the seven significant most critical effective behaviors had nearly exact counterparts among the seven significant ineffective behaviors.

2. In general, the results emphasize the high regard with which superintendents view a principal's ability in exercising psychological rather than legal authority, as behaviors stressing various phases, both positive and negative, of this attribute ranked high. A summary of the significant behaviors identifies the superintendents' conception of the "effective" principal. He is perceived as an able, responsible man of authority with personal convictions, decisive, yet not arbitrary, professionally competent, but not fervently committed to experimentation, local research, or formal professional improvement. He possesses sincere respect for, and is able to counsel and empathize with, his staff. His responsibility for good public relations is largely limited to his immediate school environment, as other phases of community relations are considered to be the province of another. He possesses educational objectives which presumably include the goals of the community, and he anticipates potential barriers to their realization.

3. In order to secure a clear and complete picture of the critical behaviors of a high school principal, other studies should consider the question from the standpoint of such reference groups as teachers, students, parents, etc. Eventually, all perceptions on which there is substantial agreement among the groups should be given credence in the formulation of critical job requirements for the high school principal.

127 pages. \$1.59. MicA 55-1365

1. H. M. Walker and Joseph Lev, *Statistical Inference*, Henry Holt & Co., New York: 1953, pp. 423-24.

EDUCATION, COUNSELING AND GUIDANCE

THE VALIDITY OF COUNSELING VARIABLES CONSIDERED IN THE ADVISEMENT OF DISABLED VETERANS ENTERING TERMINAL BUSINESS TRAINING

(Publication No. 12,154)

John Stuart Storey, Ed.D.
Michigan State University, 1955

This study is concerned with the evaluation of the counseling variables and the vocational adjustment of a selected group of seriously disabled veterans who pursued a terminal business course under the Veterans Administration rehabilitation program of World War II. The first problem was to determine which of the objective variables considered most important in the counseling of disabled veterans best discriminated between those who completed and those who failed to complete the specified training program. The second problem was to determine whether rehabilitated or discontinued veterans have made the most satisfactory vocational adjustment in the post training period.

The sample for the analysis of the counseling variables consisted of 159 male, white veterans rated as 50 percent or more disabled who entered a terminal business course during the period 1946-1949 inclusive and who resided in the Detroit metropolitan area. One hundred and four cases in the sample had completed their training, 55 had terminated short of completion. The sub-sample utilized in the analysis of the vocational adjustment of the two groups consisted of the 101 veterans of the original sample who responded to a mailed questionnaire. The response group was composed of 67 rehabilitated and 34 discontinued cases. Data relative to the counseling variables were secured from training sub-folders and medical files maintained by the Veterans Administration. Rehabilitated and discontinued groups were tested for significance of difference by either the chi-square or the critical ratio technique as appropriate.

It was discovered that no significant relationship existed between completion of training and the following counseling variables: age, number of dependents, magnitude of disability, father's occupation, related employment experience, intelligence test scores, performance on the Names Comparison section of the Minnesota Clerical Test, and scores on six scales (mechanical, scientific, persuasive, artistic, literary, and social service) of the Kuder Preference Record. A positive relationship significant at the five percent level of confidence or better was found between completion of training and the following: a high school education, orthopedic and respiratory types of disabilities, scores on the Number Comparison section of the Minnesota Clerical Test, and scores on the computational and clerical scales of the Kuder Preference Record. A significant negative relationship was found to exist between completion of training and a neuropsychiatric type of disability and scores on the musical scale of the Kuder.

No significant relationship was found to exist

between completion of training and reported earnings for the 1953 calendar year. There was a significant relationship between completion of training and expressed job satisfaction. In addition, it was found that disabled veterans who completed their training were more likely to be employed, made fewer changes of jobs, and demonstrated a greater tendency to advance vocationally than veterans whose training was terminated before completion.

The results of this study led to the conclusion that counselors of disabled veterans may have to re-direct the emphasis placed upon certain objective variables utilized in the counseling process when terminal business training is under consideration. It was further concluded that a terminal business course is an appropriate choice for seriously disabled veterans who demonstrate the proper constellation of interests and aptitudes. 111 pages. \$1.45. MicA 55-1366

EDUCATION, HISTORY

THE ORIGIN, DEVELOPMENT, AND PRESENT STATUS OF ARKANSAS' PROGRAM OF HIGHER EDUCATION FOR NEGROES

(Publication No. 12,151)

Lurline Mahan Lee, Ed.D.
Michigan State University, 1955

The Problem. This was a study of the origin, development, and present status of the State of Arkansas' program of higher education for Negroes. It attempted to explore: (1) the beginning of biracialism; (2) the evolving policy of the Supreme Court toward biracialism in higher education; (3) the economic and educational backgrounds of the Negro college students in Arkansas; (4) the quality and extent of the educational offerings available in the Negro colleges of the State; and (5) the attempt of the University of Arkansas to develop an integrated program of education on the graduate level.

It was hoped that the study might serve as a record of the unprecedented experiment, and that the experience of this State might prove helpful to other Southern states confronted with the racial issue in higher education.

Sources of Information. Data used in this study were collected from diverse sources, namely; (1) publications related to the study; (2) court records concerning discrimination in education; (3) published statistics of the public schools of Arkansas; (4) oral reports and records of Negro institutions offering undergraduate work in the State; (5) records from the offices of (a) the Dean of the School of Education at the University of Arkansas, (b) the Division of General Extension, (c) the Graduate Center at Little Rock, and (d) the State Department of Education; (6) the personal accounts of students, teachers, University officials, and State Department personnel.

Findings and Proposals for Consideration. The principal findings of the research indicate:

1. That while the problem of biracialism is an ancient one, not uniquely American or Southern, America's presentday handling of this problem has grave international implications.
2. That the Supreme Court, backed by public opinion, is becoming increasingly intolerant of biracialism in education.
3. That Arkansas' economic deprivation is reflected in all her schools and colleges, but that Negro schools and colleges in terms of proportion of youth attending, per pupil expenditures, accreditation, preparation and salary of teachers, library facilities, and scope of offerings are more adversely affected than are the white schools and colleges.
4. That since the opening of the integrated program of the University, the gap between the two races, in so far as educational indices are concerned, has begun to close.
5. That a great majority of the Negroes seeking graduate study in Arkansas are employees of either the Negro public schools or the Negro colleges.
6. That integration on the graduate level can be achieved and maintained without litigation or serious racial disturbances of any kind.

These findings suggest that the following proposals be considered:

1. That additional research and experimentation are needed to solve questions arising from this study.
2. That better personnel and guidance programs are needed in all the colleges, including the University.
3. That the cultural foundation upon which professional education is based should be greatly broadened.
4. That a program of adult education for Negroes should be developed to prepare them more fully for responsibility in civic affairs.
5. That the University of Arkansas continue to develop the program of integration and become in truth a laboratory of inter-racial fellowship.

295 pages. \$3.69. MicA 55-1367

REFLECTIONS OF THE PHILOSOPHY AND
PRACTICES OF LAMAR STATE COLLEGE OF
TECHNOLOGY AS SHOWN THROUGH
ITS HISTORY

(Publication No. 12,290)

Marvin Louis McLaughlin, Ed.D.
University of Houston, 1955

STATEMENT OF THE PROBLEM

This study was an analysis of the development and expansion of Lamar State College of Technology. It revealed how a specific college has reacted to community and area needs; it related some of the factors that brought about the expansion of the institution; and it showed some of the changes in educational philosophy that were occasioned by the interacting needs of the college community.

SOURCES OF DATA

The most important sources of data used for this problem were: official college records, including reports from the offices of the president, the dean, and the registrar; personal interviews with persons who have been closely associated with the evolution of the college; news items and editorials in local newspapers; and the theses and dissertations written on similar subjects.

PROCEDURE

The social, economic, and geographical conditions of southeast Texas were outlined to indicate the background for the establishment of a junior college in Beaumont. The junior college movement in the United States, with particular reference to Texas, was reviewed to reveal how it possibly influenced the creation of a junior college in the South Park Independent School District in 1923.

Literature pertaining to the history of South Park Junior College, Lamar College, and Lamar State College of Technology was examined; acts of the Texas Legislature that affected either the junior college or Lamar State College of Technology were inspected; and interviews were arranged with persons who have been closely associated with the schools. Finally, the historical information was organized and presented in chronological order.

SUMMARY

The need for higher education facilities in southeast Texas, the effect of the junior college movement, and the influence of L. R. Pietzsch were some of the factors that led to the creation of South Park Junior College in 1923. The college was organized and controlled by the South Park Independent School District and was considered a community school. Enrollment increased from 125 in 1923 to 303 in 1931, with the most of the increase coming during the first three years.

In 1932, the name of the school was changed to

Lamar College. It remained a part of the public school district, with no material changes being made in the administration or faculty. Then in 1940, Lamar Union Junior College District was created, and Lamar College was separated from the South Park Schools. With new facilities and an enlarged curriculum, the college prospered.

A movement to expand Lamar College into a four-year state-supported school culminated in the creation of Lamar State College of Technology in 1951. Since that time, the curriculum has been liberalized and expanded to include many areas of study, some of which are not of a technological nature.

Some guideposts that appear to indicate the course of future development for the college are: (1) present plans for the expansion of physical facilities, (2) a changing emphasis on curricular offerings, (3) an estimate of future enrollment, (4) efforts that have been made to obtain approval by accrediting agencies, and (5) state-level plans for co-ordinating higher education in Texas.

The philosophy of Lamar State College of Technology has changed with the several periods of its internal organization. There has been a marked and rapid shift in educational philosophy from that of a public school, college preparatory view serving a restricted and local area to that of a state college offering training on a four-year advanced level in a variety of fields. 294 pages. \$3.68. MicA 55-1368

EDUCATION, PHYSICAL

MEASURED EFFECTS ON CHILDREN IN THE
PRIMARY GRADES FROM USE OF SELECTED
PLAYGROUND EQUIPMENT

(Publication No. 12,114)

Margaret Ruth Morris, Ph.D.
State University of Iowa, 1955

Chairman: Professor M. Gladys Scott

The purpose of this study was to measure the effects on arm and shoulder girdle strength and flexibility of children in the primary grades from the use of selected playground equipment. A door-way bar, parallel bars, and a combination unit constituted the equipment. The combination unit which the author had constructed consisted of horizontal and vertical ladders, parallel and horizontal bars, ring and trapeze. The study extended over an eleven week period and was conducted in two parochial schools in Iowa City, Iowa. The experimental group consisted of ninety-four children in the first, second, and third grades in St. Mary's Parochial School; the control group consisted of one hundred twenty-seven children in the same grades of St. Patrick's School. The children of the experimental group had an opportunity to use the equipment daily. Each grade was divided into

two groups. Each group had a fifteen minute period for participation in activities using the equipment.

Measurement of arm and shoulder girdle strength was obtained by computing the mean gains of the composite strength scores of both groups. The composite strength scores were ascertained by summing the T-scores of four arm and shoulder girdle strength tests. The mean gains were computed from the differences obtained from the composite strength scores secured at the beginning and at the end of the study. To determine the importance of the difference between group means, the "t" test of significance of a difference between means was applied.

At the conclusion of the study, a flexibility measurement was taken, also, and group means were computed. The "t" test of the significance of a difference between means was used to determine whether or not the differences between groups were real.

It is believed that the following conclusions can be made from an analysis of the results of this study:

1. The arm and shoulder girdle strength of the children in the primary experimental group was increased by use of selected playground equipment. For the most part, the gains were highly significant as indicated by the "t" beyond the one per cent level of confidence.

2. The arm and shoulder girdle strength of the girls in the experimental group increased more than the arm and shoulder girdle strength of the boys in the experimental group.

3. No significant relationship was found between arm and shoulder girdle strength and flexibility in this study.

4. No significant difference was found in the flexibility of the two matched groups at the conclusion of the study.

5. Flexibility of the girls was found to be slightly greater than that of the boys. Flexibility, also, appeared to decrease with age.

The following recommendations for further study are suggested:

1. Similar studies at different age levels; the intermediate, junior high school, and the senior high school.

2. A study to determine the amount of time required to build a specified amount of arm and shoulder girdle strength through use of selected playground equipment.

3. A follow-up study to show the effects on skill performance partially dependent upon arm and shoulder girdle strength.

4. A study to determine the amount of arm and shoulder girdle strength which is desirable and a study to determine how best this could be maintained.

92 pages. \$1.15. Mic 55-131

EDUCATION, PSYCHOLOGY

EVALUATIONS OF ANTI-SOCIAL BEHAVIOR BY DELINQUENTS

(Publication No. 12,254)

Shepard Alvin Insel, Ed.D.
Stanford University, 1955

It is assumed by students of the social scene that the delinquent perceives society and its values differently than does his more conformist brothers. This study addressed itself to the problem of testing the above assumption by comparing the perceptual field of the delinquent with that of others in his society.

Since the focus of attention is upon anti-social behavior when delinquency is at issue, the specific question raised was whether the delinquent perceives anti-social or delinquent behavior differently from others in his society.

One dimension of anti-social behavior is the degree of seriousness by which such behavior is perceived by the individual in society. Assuming that the degree to which society sanctions such behavior defines its relative seriousness, the major hypothesis of the study was that the delinquent would tend to perceive the seriousness of an anti-social act differently from a non-delinquent.

Thirty-two boys legally adjudged as delinquents - boys who had been confined in a juvenile detention hall in the San Francisco Bay region - were matched along six variables with an equal number of non-delinquents. The delinquents were back in high school under the supervision of probation officers. The differences with respect to the variables of age, sex, grade, color, intelligence, and socio-economic status were statistically non-significant.

A third group, made up of thirty male teachers from the same high school as the teen-agers in the study, was defined as representing the normative evaluations of the society.

A series of seventy statements of specific crimes was developed from the California State Penal Code. These items were pre-tested for readability. Each item was placed on an individual card and the subjects were asked to rank the items on a Q-sort distribution according to relative seriousness. The test-retest reliability coefficient computed on thirty-two ninth grade boys was .70.

A rank difference correlation coefficient was computed for each matched pair, and when the Fisher z transformation was applied, the resulting mean r was equal to .59.

Each delinquent's rank was correlated with a rank established by a composite of the teachers' ranks. After applying the z transformation, the resulting mean r was equal to .70.

Each non-delinquent's rank was also correlated with the teachers' composite. The resulting mean r was .71.

It was hypothesized that the delinquent's perceptions of anti-social behavior are more variable than those of non-delinquents or teachers. This hypothesis was tested by deriving a deviation score for each subject

by finding the difference between an individual's valuation of an item and the mean valuation for that item as perceived by the group of which the individual was a member. Each subject received a total deviation score. A mean deviation score was computed for each group. The t-ratio computed to evaluate the mean differences between the delinquents and non-delinquents was found significant at the .02 level of confidence. No significant differences were found between the teacher group and the delinquent or non-delinquent groups.

A third hypothesis was that delinquents tend to perceive the seriousness of categories of crimes differently than do non-delinquents or teachers. Each of the seventy crimes was placed in one of five categories: (a) crimes against persons; (b) crimes against property; (c) crimes against public justice; (d) crimes against public health, safety, and peace; and (e) crimes against public decency and good morals.

Each group ranked the first three categories in the same order, but the teachers differed with the delinquents and non-delinquents on the last two categories. Highly significant differences, moreover, were found when within-rank differences were evaluated.

A final hypothesis was that delinquents would tend to over-or under-rate the acts with which they were charged when compared with the mean evaluations of these acts of delinquents, non-delinquents, or teachers. No significant differences were found.

The present study, then, does not tend to support the general hypothesis that delinquents evaluate anti-social behavior differently from others in their society. Implications for education were discussed.

66 pages. \$1.00. MicA 55-1369

VERBAL SOLUTIONS TO PARENT-CHILD PROBLEMS AND REPORTS OF EXPERIENCES WITH PUNISHMENT

(Publication No. 12,061)

Philip Wesley Jackson, Ph.D.
Columbia University, 1955

This study concerned (1) the types of controls placed upon children's behavior by parents, and (2) adult's reports of their own experiences with punishment. One hundred and sixty-seven college freshmen and sophomores and one hundred and five parents of these students participated in this study. The data of this study consisted of verbal accounts of (a) what the subjects said they would do in facing certain hypothetical parent-child situations, and (b) the subjects' responses to questions which concern their own experiences with punishment.

The major results of this study may be summarized as follows:

1. Certain methods of control were suggested much more frequently than were others by all subjects. Agreement concerning the methods of control which should be used varied considerably depending upon the situation to which they were responding.

Agreement was highest in response to those situations which seemed to call for either very "mild" or very "severe" methods of control.

2. The methods of control suggested by all the subjects tended to be skewed toward the "mild" end of a continuum of coercion. This was partially a result of the fact that mild methods of control were usually suggested singly whereas when the subjects suggested severe methods of control they usually suggested the use of milder methods as well.

3. Women suggested the use of methods of control that were more severe than those suggested by men. However, women also suggested the use of controls that were milder than those suggested by men. Thus, women seemed to show a greater fluctuation in the severity of the methods of control they suggested than did men.

4. College students suggested both severer and milder methods of control than did their parents.

5. Both parents and college students tended to suggest more than one method of control in response to a single situation. This was especially true in the responses to those situations which seemed to demand the use of severe methods of control.

6. Among those responses of parents and college students in which more than one method of control was suggested the sequence of the controls, in terms of their severity varied considerably. The sequence which appeared most frequently was: mild methods of control followed by severer ones.

7. The parents and college students reported, in general, that the punishments they received as children were justified and adequate in amount. The subjects reported that they were punished as severely and as frequently as were their siblings. However, they also reported that they were punished less severely and less frequently than were the other children in their neighborhood.

8. There was agreement upon the age periods during which punishment was most frequent and severe. According to the reports of both parents and college students punishment was most frequent and most severe during the period from 8 to 12 years of age.

9. Parents and college students agreed, in general, that "mother" was the person who punished them most frequently and that she was also the person by whom they would prefer to be punished.

10. College students who were "first born" or "only" children reported punishments that were more severe and more frequent than were those reported by subjects who were "middle" or "last born" children.

11. The reports of college students concerning their experiences with punishment tended to resemble corresponding reports by their mothers more than they resembled corresponding reports by their fathers.

12. College students judged the punishments they received as children as being more severe and frequent than did the parents who administered these punishments.

143 pages. \$1.79. Mic 55-132

**TEST AND BACKGROUND FACTORS
RELATED TO DROP-OUTS IN AN
INDUSTRIAL INSTITUTE**

(Publication No. 11,993)

Cecil Holden Patterson, Ph.D.
University of Minnesota, 1955

Problem. The purpose of the study was to determine if the drop-out rate in a private industrial institute could be reduced by use of test scores and background information.

Sample. The sample consisted of 350 students enrolling in 14 courses of a mechanical nature in a private industrial institute in the fall of 1953.

Design and Procedure. Prior to the start of training the sample was administered a questionnaire and a battery of tests including the Revised Minnesota Paper Form Board, the Bennett Mechanical Comprehension, and the Army General Classification Tests, and the Kuder Preference Record, Vocational. The criterion consisted of the dichotomy of completion or failure to complete six months of the 18 month course since the major proportion of dropouts occurs during this period. The total group was split into two random halves, each serving as a cross-validation group for the other. Background factors were analyzed by use of the X^2 statistics. The test results were analyzed by means of the linear discriminant function.

Results. Of 16 background factors studied seven differentiated between drop-outs and those completing 6 months of training at or beyond the .05 level in one of the groups or the total group. Using the results for the total group, it appears that age (ages 20-29 being most favorable), high school graduation, the number of mathematics and shop courses reported completed, the type and number of science courses taken, and having had some work experience other than farm work are associated with completion of 6 months of training. In addition, non-disabled Korean veterans tended to be more likely to continue in training than non-veterans.

The best combination of test scores was the Paper Form Board, Bennett and AGCT-Total scores. Part scores on the AGCT and Kuder scores were not useful. Addition of two of the most significant background factors - number of mathematics and number of shop courses taken - did not improve the discrimination achieved by the test scores. Weights derived for the test scores in each group were applied to the other group. In one case these weights discriminated significantly better than chance in the other group, but in the other case they did not. Weights were derived for the total group, since these weights would be more stable than those for the sub-groups. These weights should be cross-validated in another sample.

Conclusions: It appears to be possible to reduce the drop-out rate in this school by use of the tests studied. However, the fact that the discrimination achieved was of the magnitude suggested by a multiple point-biserial R of .45 indicates that most of the variance of the criterion is not accounted for by the variables studied. Kuder interests are not significant. Background factors cannot be used as a substitute for

tests, and do not add to the tests; their valid variance is apparently covered by the tests. Suggestions for the further research are made. It is possible that there are differences among courses which would warrant separate treatment of certain courses or groups of homogeneous courses. This appears to be more likely the case for Kuder interests than for the other tests studied. The linear discriminant function is suggested as appropriate for the study of course differences as well as the discrimination of drop-outs from those completing a period of training.

356 pages. \$4.45. MicA 55-1370

EDUCATION, TEACHER-TRAINING

**A STUDY OF CHANGES OCCURRING IN
TEACHERS' SENSITIVITY TO HUMAN
DEVELOPMENT PRINCIPLES CONCURRENT
WITH PARTICIPATION IN A THREE YEAR
PROGRAM OF CHILD STUDY**

(Publication No. 12,079)

Elizabeth Rowell Duff, Ed.D.
University of Maryland, 1955

Supervisor: Professor Madelaine Mershon

Purpose

The purpose of this study was to determine what changes took place in teachers' sensitivity to human development principles as they progressed through three years of Child Study experience. The study (1) compared teachers' sensitivity to human development principles before and after each year of Child Study and before and after combinations of years, and (2) determined the nature of change taking place and the statistical significance of the change observed. Use of interview as a research instrument was investigated.

Procedure

The data utilized in the present research were collected prior to and after each specific year of the three year program. Data were gathered through open-ended interview technique. The teachers comprising the sample were participating in the Child Study program in a Southeastern community of the United States. The sample included paired interviews before and after each year as well as all interview data available in the four interview periods.

The basic hypothesis and sub-hypotheses of this study are:

In regard to children, teachers will reveal increasing sensitivity to the basic underlying principles of human development as they progress through three years' participation in the inservice program of Child Study. Teachers will become increasingly sensitive to:

1. The underlying causes of behavior

2. the multiplicity, complexity, and interrelatedness of behavioral causes
3. the importance of reserving final judgment about children pending further information
4. the importance of using the internal frame of reference as a basis for understanding children
5. the importance of respecting children
6. the importance of providing enriching experiences in the areas of physical, affectional, peer, socialization, and self processes of children
7. the importance of seeing the optimum development of children in terms of each child reaching his own maximum potential

A framework was used in processing data. Judges were used to establish the validity of the framework. Reliability was established by a check ten weeks after data were analyzed. Chi square and the null hypothesis were utilized in analysis of data. The null hypothesis was rejected at the .01 level of significance. Sensitivity was accepted for data reaching .05. A trend was indicated at .10.

Findings

All seven sub-hypotheses were supported by year combination comparisons. Significant difference was found in all instances when data were compared before the first year and after completion of the Child Study experience.

From the present research it may be concluded that teachers do change in sensitivity to human development principles as they progress through three years in the Child Study program. Change is slow, positive, and in line with the desired outcomes of the program.

The present research would indicate that the Child Study in-service education for teachers should consist of a minimum of three years if outcomes similar to those produced are desired. This is particularly true in regard to change concerning teachers' attitudes toward children and change in curriculum practices. The present research also indicates that interview has value as a technique for collecting data to be used in similar studies. 164 pages. \$2.05. MicA 55-1371

AN ANALYSIS OF THE PROBLEMS OF A SELECTED GROUP OF STUDENT TEACHERS

(Publication No. 10,662)

Charles A. Goddard, Ed.D.
New York University, 1954

Chairman: Forrest E. Long

The purpose of this study is to describe and analyze the problems of a selected group of New York University secondary school student teachers in order to suggest implications for the program of teacher education at New York University. Principal sources of data were thirty-two New York University student teachers who did their student teaching in English, social studies and science in the New York area.

Problems of the selected group were gathered from diaries kept by the student teachers. Other data were gathered from individual and group conferences of student teachers. At the end of the study, the problems reported by the selected group were incorporated into a classification system which was the basis for questionnaires submitted to cooperating teachers and student teachers of the selected group and to comparison groups. Purposes of questionnaires were to collect data concerning the relative importance of problems and the relative length of time involved in effecting resolutions of problems. Questionnaires were also submitted to supervisors of student teachers in order to find out supervisors' opinions concerning the problems reported in the study.

Forty-six kinds of problems are reported in the study. There are three kinds of functional difficulties, namely, problems in observation, participation and classroom instruction; four kinds of relational difficulties, namely, problems arising from the relationships of student teachers with pupils, cooperating teachers, supervisors and cooperating school staff members; and personal problems.

An analysis of data concerning the causes of problems shows that student teachers and supervisors named such factors as the inexperience of student teachers, certain deficiencies of student teachers, weaknesses in the program of professional preparation and differences in terms of personality, purposes and philosophies of education between student teachers and cooperating teachers. The investigator infers that problems arise for student teachers in ways such as the following: when student teachers play new roles and when the purposes of student teachers are blocked. In addition, the investigator infers that problems arise for student teachers because of differences in perception of student teachers, cooperating teachers and supervisors.

An analysis of data concerning ways by which student teachers resolved their problems shows that student teachers resolved their problems in such ways as the following: changing their teaching methods, effecting self-improvement and improving student teacher-pupil relationships. The investigator identifies six kinds of student teaching conferences which are used to aid student teachers. Cooperating teachers are named by student teachers the greatest number of times as the professional people who were helpful to student teachers and the investigator infers that, as cooperating teachers help student teachers, they play new roles such as "demonstrators," "permission givers" and "security givers." Supervisors are named the next greatest number of times as the professional people who were helpful to student teachers and the investigator infers that, as supervisors help student teachers, they play roles such as "compensators," "arbitrators" and "security givers."

Among the implications of the study for the program of professional preparation at New York University are the following: the importance of the personalities of student teachers as critical factors in student teaching; the need of prospective teachers to learn how to relate themselves to adolescents; the use of observation, participation and special methods courses -

the investigator suggests that these three experiences be combined in one course before and during student teaching; the importance of careful selection of cooperating teachers; and the use which can be made of the diary as an instrument for gathering data in preparatory courses and in student teaching.

360 pages. \$4.50. MicA 55-1372

THE LOST WAX PROCESS AND ITS USE IN INDUSTRIAL ARTS

(Publication No. 11,679)

Ira H. Johnson, Ed.D.
Bradley University, 1955

The purpose of this study is twofold: (1) to investigate the procedural steps of the lost wax process and write an instructional manual for industrial arts use; and (2) to provide the author with experience in the experimental method of solving an industrial arts problem.

The study is divided into three parts. Part One - Research Study - describes the problem, states the purposes, explains the procedures, and tells how the instructional material was compiled. Part Two - Instructional Manual - contains the descriptive and pictorial material and other related aids under the following chapter headings: (1) Statement to Industrial Arts Teachers; (2) Development of the Lost Wax Process; (3) The Lost Wax Process; (4) Place in Industrial Arts; (5) Master Model Procurement; (6) Rubber Mold Fabrication; (7) Wax Pattern Fabrication; (8) Investment; (9) Wax Removal; (10) Metal Casting; (11) Investment Removal; (12) Glossary; and (13) Sources of Supply. Part Three - Concluding Statements - suggests additional needed research and expresses some significant trends.

The approach to the problem was made by an extensive survey of printed material, by visiting many appropriate industries in the central and eastern part of the United States, and by thorough experimentation in all of the procedural steps of the process.

An extensive bibliography provides a listing of available literature about the lost wax process. A selected bibliography is also provided since certain entries are denoted to indicate that they are especially pertinent for industrial arts use.

153 pages. \$1.91. MicA 55-1373

CRITERIA FOR EVALUATING PROGRAMS IN AGRICULTURAL EDUCATION FOR BEGINNING TEACHERS

(Publication No. 12,185)

Austin Everett Ritchie, Ph.D.
The Ohio State University, 1955

The purpose of this study was to develop evaluative criteria for use in appraising programs of professional

in-service education for beginning teachers of vocational agriculture.

The evaluative criteria were developed from related literature and studies, with the assistance of fifteen jurors from fifteen states throughout the United States. Two instruments were utilized: one for securing data concerning programs of in-service education for beginning teachers of vocational agriculture, the other for evaluating programs of in-service education for beginning teachers and for securing the jurors' appraisal of the evaluation instrument. The evaluative criteria were revised in the light of the jurors' application and validation and at the discretion of the author.

The sixteen guiding principles proposed by the writer for use in appraising programs in Agricultural Education for beginning teachers were accepted by 80 to 100 per cent of the jurors. Only one principle was rejected by three jurors. The principles are concerned with professional leaders, individual differences, cooperative planning, coordinator and policies, learning experience, professional improvement, general school objectives, long-range planning, farming programs, adult education, Future Farmers, guidance and counseling, physical facilities, records and reports, public relations, and evaluation.

There were 67 check list items proposed with the guiding principles. Of the 67 items, three were deleted and one was added to the evaluative criteria in accordance with the jurors' appraisals and comments. Of the 1,005 possible appraisals, 90 per cent were in agreement with the check list items.

Sixty-four percent of the jurors agreed with the evidences sought in the evaluative criteria. The rating scale for the check list - "good," "fair," "poor," "missing but needed," and "does not apply" - was agreed upon by all of the jurors.

Ninety-eight per cent of the possible 240 jurors making appraisals marked "agree" in rating the evaluation scale consisting of descriptive and numerical values. The "Individual Evaluation" and "Committee Evaluation" summaries were appraised "agree - much" by 73 per cent of the jurors.

The programs of in-service education for beginning teachers of vocational agriculture were evaluated from "low - good" to "low - fair," one each respectively. Eight programs were evaluated "high-fair," and five programs were evaluated "mid-fair." The evaluations of the 15 programs by guiding principles were: "high-fair" for Future Farmers, professional leaders, individual differences, and farming programs; "mid-fair" for coordinator and policies, adult education, general school objectives, physical facilities, cooperative planning, learning experience, public relations, long-range programs, records and reports, and evaluation; "low-fair" for professional improvement; and "high-poor" for counseling.

A direct correlation was evident between the overall evaluations of the 15 programs and their evaluations by the guiding principles. The mean scores were 4.6 and 4.67 respectively.

The recommendations made in the light of the findings regarding the "Evaluative Criteria for In-service Education with Beginning Teachers of

Vocational Agriculture" were: (1) that the criteria should be used by teacher educators in agriculture and supervisors of vocational agriculture, and by other personnel involved, as a means of evaluating and improving beginning-teacher programs; (2) that the criteria should be used and an analysis be made for identifying some standards and the relative importance of the components; (3) that the criteria be further tested through use and revisions made whenever the components were found to be inadequate, unreliable, invalid, or outmoded; and (4) that a digest of the study should be printed and made available to teacher educators in agriculture, to supervisors in vocational agriculture, and to libraries serving teacher-education departments in colleges and universities.

251 pages. \$3.14. MicA 55-1374

CERTAIN ATTITUDES ABOUT CHILDREN HELD BY PRE-SERVICE TEACHERS

(Publication No. 12,094)

Donald F. Stanger, Ed.D.
University of Maryland, 1955

Supervisor: Professor Walter B. Waetjen

Purpose:

This study is an investigation into certain attitudes about children held by pre-service teachers. Through examination of attitudes one source becomes available for some evaluation of the undergraduate program in human development education at the University of Maryland.

Procedure:

Undergraduate seniors in education at the University of Maryland who had completed or nearly completed two semesters of human development education were administered an adaptation of the Thurstone equal-appearing interval attitude scale. The instrument utilized endorsement of opinions about children and the school situation as a means of measuring attitude.

Two groups of graduate students were administered the scale also. One graduate group was composed of advanced students and became designated as the criterion group. The other graduate group had less human development education than the Maryland undergraduates and served the purpose of acting as a discriminatory sample for purpose of lending validity to the instrument.

Finally, two groups of undergraduate seniors in education who had never had human development education as such were given the scale. Both groups came from teacher education institutions, one in Pennsylvania, the other in New Jersey. Measurement of attitude was made through scale results, comparing all groups to the criterion group. This was accomplished for the scale as a whole and in each of six breakdown areas. Categorical headings for the six subdivisions pertained to the following concepts:

- 1) Multiple causation of behavior
- 2) Individual valuableness
- 3) Individual uniqueness
- 4) Developmental tasks
- 5) Adjustment problems
- 6) Scientific concepts

Findings:

The undergraduates at Maryland were significantly different in the postulated direction from the undergraduates at those institutions not having human development in reference to the entire number of items on the scale. The difference was not great enough, however, when the scale was broken down into the six specific categories to reveal consequential distinctions in any of the breakdown areas.

Although the significant differences were of the manner and in the direction it was hypothesized they would be, they were not nearly so strong as expected.

181 pages. \$2.26. MicA 55-1375

EDUCATION, THEORY AND PRACTICE

TEACHER-PUPIL PLANNING IN BUSINESS EDUCATION (VOLUMES I AND II)

(Publication No. 12,012)

Denzel Loren Carmichael, Ph.D.
The Ohio State University, 1954

Adviser: J. M. Hanna

Description of problem. The primary purpose of the study was to implement the philosophy of teacher-pupil planning for business education. A secondary purpose was to evaluate the extent and nature of the thinking and practices in business education with respect to teacher-pupil planning.

In attacking the problem of this study, the literature of education was utilized for expressing the philosophy of teacher-pupil planning. The literature of business education was used for the implementation of the philosophy and for the evaluation of the thinking and practices within business education.

Summary of the philosophical bases. The primary function of education in the United States is to develop democratic citizenship. If educational programs are to develop democratic citizenship, social environments must be created which will enable students to practice democracy in the school.

Practicing democracy involves giving students the experience of cooperatively planning and carrying out their learning activities with their teachers. "Teacher-pupil planning" was the term used in the study to identify the process by which students can be given such experiences.

Teacher-pupil planning concepts must permeate the complete school program if the school is to

discharge successfully its responsibility for developing democratic citizenship. If it is to justify its inclusion in the curriculum, business education must contribute to the major objective of education by utilizing teacher-pupil planning concepts.

Summary of conclusions. In terms of the totality of the literature of business education, little attention is given to the philosophy of teacher-pupil planning. However, in the aggregate there is a sizable body of materials which throw light on the implementation of the philosophy for business education.

There are many opportunities for student participation in all phases of the learning situation in business education which will contribute to the development of the characteristics and skills needed for successful democratic living. These characteristics and skills are the same as those needed for successful participation in business.

Teacher-pupil planning can be employed effectively in both the skill and non-skill areas of business education. Certain differences exist in skill areas, as contrasted with non-skill areas, where problems concerning degree of skill are being attacked. These differences point toward more teacher direction in the beginning stages of skill development and to more individual work under the guidance of the teacher in skill areas as contrasted with teacher guidance of group work.

Certain differences exist between shorthand and typewriting with reference to student participation in the learning situation. Because of these differences, the period which calls for more teacher direction would be longer in shorthand than in typewriting.

If business education is to move in the direction of teacher-pupil planning, the greatest need, other than the acceptance of the philosophy on which teacher-pupil planning is founded, is the construction of resource units which could be used by teachers in their pre-planning for the learning situation.

750 pages. \$9.38. MicA 55-1376

A DETERMINATION OF THE RELATIVE IMPORTANCE OF KNOWLEDGES OF SCIENCE TO THE DUTIES OF HOTEL MANAGERS

(Publication No. 10,630)

Albert Frank Eiss, Ph.D.
New York University, 1954

The Problem and Its Importance

The hotel industry is a young, but rapidly growing industry, ranking high in comparison with other industries. Until recently, higher education for hotel executives has been neglected. Many schools are introducing a Hotel Management curriculum, but they lack a sound basis for determining content, particularly in science. There is a wide divergence of opinion concerning the amount of science that hotel managers need to know in the performance of their duties; consequently, this study was made for determining the relative importance of knowledges of science to the duties of hotel managers.

The Historical Background of the Problem

Most decisions concerning the curriculum and its content have been made on the basis of expert opinions, with tradition exerting considerable influence. Many educators have advocated a more functional approach to the problem. W. W. Charters has pioneered the movement, followed by Adams, Mallinson, Mason, Sties, Wise and others. Job analysis techniques have been applied mainly to secretarial and industrial training; usually being used to derive techniques and skills rather than knowledges or principles. It has not been used for hotel managers.

Procedure Used in Collecting Data

A questionnaire was prepared in cooperation with experts in the hotel industry for the purpose of defining and deriving the relative importance of duties of hotel managers. The derived data were analyzed to determine the relative value of each duty which involved knowledges of science.

Knowledges were derived from a study of various source materials, using criteria that were derived and validated by experts. The relative importance of the knowledges to the managers' duties was derived, and the reliability of both the returns and ratings was determined.

Analysis of Data

Fifty-three replies were received from 123 letters written, a forty-three per cent return. Managers of small hotels were interviewed personally. A determination of the reliability of the differences between means showed that managers of small hotels perform duties involving knowledges of science to a greater extent (within the .01 level) than managers of larger hotels.

Knowledges which were derived were examined on the basis of validated criteria to determine their relative importance to the twenty-six selected duties. Most of the 640 knowledges of science which were found important could be classified under biochemistry or physics; the most important knowledges were related to health and safety.

Conclusions and Recommendations

Knowledges of science are important to managers of small hotels to a significantly greater extent than to managers of larger hotels. Physics and biochemistry should receive primary consideration in training hotel managers in science.

A greater emphasis should be placed on a more functional approach to the problem of determining objectives and content of courses of study in higher education. Emphasis should be on a comprehensive study of the selected subject matter, rather than emphasizing conventional subject-matter divisions. Knowledges should be integrated with related materials and practical applications. The vocabulary used should be nontechnical to be comprehensible to the student taking the course. The compilation of a list of available films and other related aids would be of great help in preparing such a course.

The technique used in this study could be used to advantage in other fields, such as forestry and home economics. It is hoped that further studies of this nature will be made. 172 pages. \$2.15. Mic 55-133

BASES FOR MAKING CHANGES IN PROGRAMS
OF VOCATIONAL EDUCATION IN
AGRICULTURE IN CENTRAL RURAL SCHOOLS
IN NEW YORK STATE

(Publication No. 9766)

Frank H. Nearing, Ph.D.
Cornell University, 1954

Purpose:

The study was concerned with the factors affecting programs of training in vocational education in agriculture. It considered the needs and interests of pupils, the human and social resources of communities, the programs of training for agriculture in the several departments and the effectiveness of previous programs of vocational education in agriculture representing different types of farming in three counties in New York State, namely, Cayuga, Monroe, and Delaware.

Method:

An investigation was made of the changes in size and type of farming, in part-time and full-time farming and in the rural resident status of the population as it related to the type of agricultural education program to be offered. Pertinent data regarding the schools and communities; school enrollments; programs of studies; types of courses in agriculture; employment status of parents; guidance services and placement of graduates were secured.

Vocational experiences of 2779 former pupils of Vocational Agriculture who completed their courses or dropped out of school prior to completion were examined and reported.

A questionnaire was prepared and a survey made of 1361 boys in grades eight through twelve in the 25 central rural schools in the three counties to obtain pertinent data regarding the relationships between their home situations and the types of programs in vocational education in agriculture that should be offered.

Findings and Interpretations:

Fourteen per cent of the pupils in Delaware County, 30 per cent in Cayuga County, and 43 per cent in Monroe County enrolled in Vocational Agriculture were from non-farm situations. Opportunities for training in farming have not met the needs of all pupils who enroll in courses in Vocational Agriculture. There is a problem in central rural schools, especially those near urban areas, of formulating desirable programs for training for rural village and non-farm boys.

Approximately 40 young farmers between the ages of 18 and 35 years who might benefit by instruction in agriculture, were found in each central school area. Training and experience activities in farming must be continued beyond high school to insure successful placement, establishment and continued advancement in farming for farm youth. The department of Vocational Agriculture in the local school is the only agency prepared to discharge this responsibility.

A study of the curriculums chosen by pupils in high school were found to correlate favorably with their choices of occupations in the professional, business and clerical, and agricultural groups of occupations. Eight-five per cent of the pupils desiring to farm were enrolled in Vocational Agriculture. However, those desiring to enter crafts and operative trades were enrolled in curriculums that could not be expected to train them for that kind of work. In 1953, those pupils desiring to enter craft or operative trades in one county were found to be enrolled as follows: 54.5 per cent in Vocational Agriculture, 16.4 per cent in college entrance, 7.3 per cent in commercial, and only 21.8 per cent in industrial arts. Desirable courses of training should be developed to fit the needs and interests of these pupils. Programs for training in Vocational Agriculture should not be unduly influenced by the needs of pupils who do not plan to prepare for farming.

A high percentage, 60 per cent of former pupils of Vocational Agriculture in the three counties surveyed were farming at the time of the study. Approximately 75 per cent were engaged in work directly related to the type of training which they pursued in high school.

Thirty-three major factors about population, occupations, changes in farming and about the schools and pupils which affected programs of training in vocational education in agriculture were investigated. The study indicated that schools should continue to offer courses in Vocational Agriculture wherever the following conditions apply:

- The rural-farm population remains high
- The number of gainfully employed males in farming has been favorably maintained
- A high percentage of former pupils are farming
- Need for replacements of farm operators and others in related farm occupations requires all of the youth trained in departments of agriculture
- A high percentage of the land should remain in permanent agriculture
- The area is maintaining permanent types of farming with a favorable ratio of commercial farms to part-time farms
- Boys in Vocational Agriculture show substantial returns from their supervised farming programs
- The teacher of Vocational Agriculture can profitably devote his full time to farm boys enrolled in school and to out-of-school farm youth
- School enrollments are being maintained or increasing with a favorable ratio of farm to non-farm boys
- There are sufficient numbers of pupils who select the Vocational Agriculture curriculum to require the services of one or more full-time instructors

276 pages. \$3.45. MicA 55-1377

A STUDY OF COMMON ELEMENTS IN ENTRY JOBS

(Publication No. 12,284)

Harold Jean Steffen, Ph.D.
Cornell University, 1955

This study of entry jobs in industry and business was made in an attempt to uncover some facts which could be useful in assisting young people in meeting and understanding the problems of making a living in an industrial society, especially those who will enter employment which does not require special training before being hired.

One hundred fifty such entry jobs were studied, through personal interviews and observations. Each job was examined with forty elements as points of reference. The jobs were arranged in seven occupational groupings: service workers, sales personnel, clerical personnel, single-skilled specialists, multi-skilled specialists, trade helpers, and laborers. The jobs were located in fifty seven organizations in Central New York State. Data were obtained by personal interviews with and observation of the worker, and by interviews with representatives of management under whom the workers were employed. Seventy three such representatives were interviewed.

The data concerning the various jobs were tabulated for each of the forty elements studied. Conclusions drawn from the data indicate a need for positive learning in the public schools concerning unions and their place in an industrial society, wages in entry jobs, job pressure periods and how to face them, fitting into a detail job where the worker performed only a portion of the whole task, the cyclical nature of many jobs, the need for and purpose of supervision, human relations and their importance in work life, the importance of care and maintenance of tools, the need for record keeping in many jobs, the use of reference manuals and other materials, and the variety and use of vehicles used in industry.

Interviews with management pointed out the need for greater cooperation between industry and the schools, the need for young persons to get some experience with an eight-hour day before leaving school, legible writing of records, and willingness on the part of the young entry worker to put in a full day's work. Management appeared to prefer young workers above the age of eighteen, and disliked the hiring of sixteen-year-olds.

Some ways suggested to implement the findings are the establishment in the schools of short units of instruction covering such areas as mass production, plant vehicle operation, human relations on the job, and preventive maintenance of equipment; and the greater utilization by the schools of community resources through plant visitations, and the use of business and industrial representatives for talks to classes.

The study seems to reveal many common elements in entry jobs. 208 pages. \$2.60. MicA 55-1378

THE USE OF PROFESSIONAL TIME BY TEACHERS OF VOCATIONAL AGRICULTURE IN GEORGIA

(Publication No. 12,040)

Ralph Harmon Tolbert, Ph.D.
The Ohio State University, 1954

Adviser: W. F. Stewart

The purposes of this study were (1) to analyze the use made of professional time by teachers of vocational agriculture in Georgia; (2) to identify the teachers who had made the best use of their time; (3) to propose appropriate guides for the development of teacher loads; and (4) to propose ways and means whereby local programs of vocational agriculture may be improved through better use of teacher time.

Data for the study were provided from the monthly reports and from personal interviews with a random sampling of 35 teachers in single-teacher departments and each of the 17 teachers in multiple-teacher departments. Data from the multiple-teacher departments were utilized only to determine the differences between over-all time use of teachers in such departments and time use of those in single-teacher departments. The study covered the fiscal year, 1951-52.

Criteria, growing out of a statement of philosophy of education which were examined, revised, and approved by a jury, were used to identify the eight teachers of the single-teacher departments who had made the best use of their professional time. The selection was tested by determining how significantly different the time use of these "top" teachers was from the time use of the "bottom" teachers, those who, by the same criteria, were found to have made the poorest use of their time. The proposed guides for the development of teacher loads were based on the use that the eight "top" teachers had made of their professional time.

Teachers in single-teacher departments were found to have devoted 2,810 hours to professional duties during the year 1951-52, an average of 56.2 hours per week. These teachers devoted 2.3 more hours to their professional duties than the teachers in multiple-teacher departments. Otherwise, there was very little difference in the use that the two groups of teachers made of their time. When the different areas of activities were ranked for the two groups in the order of the amount of time devoted to each area, there was little difference in the relative positions of the different areas for the two groups.

The general pattern of teacher load was for the teacher to teach three or four classes of all-day boys, either a day-unit, farm-shop, or young-farmer class, and from one to two adult classes. All but one teacher in the group had at least one adult class.

Analysis of the amount and the percentage of time devoted to professional activities during the summer months revealed a wide variation among the 35 teachers in the distribution of their time among the different areas of activities.

On the average, the teachers taught 47 all-day boys and spent 40 per cent of their professional time with this group. The boys were visited on an average

of 5.7 times during the year. First-year boys were not visited as frequently as the other all-day boys but received more visits the second half of the year than the first half. Supervisory visits were made on two-thirds of the workdays.

Thirty-four of the 35 teachers taught an average of 43 adults in 1.5 classes. Ten per cent of their time was utilized in work with organized adult classes. Less time, however, was devoted to work with organized adults than was devoted to work with adults who were not necessarily members of adult classes.

Only one out of seven teachers was found to be teaching young-farmer groups. Two-thirds of the time devoted to groups was spent in on-farm supervision. Members of these groups received more supervisory visits than members of any other group.

One of the significant findings of the study was that, although the "top" teachers had been selected on the basis of criteria which represented a rather broad base, the only area of activities where there was a statistically significant difference between the "top" and the "bottom" teachers was that of on-farm supervision. Here, however, definite superiority was shown on the part of the "top" teachers, and the difference was great enough, in almost all items, not only to justify significant difference but even virtual certainty.

Guides for use in planning and developing local programs of vocational agriculture were developed which utilized the pattern of time use established by the eight "top" teachers.

199 pages. \$2.49. MicA 55-1379

ENGINEERING

ENGINEERING, AGRICULTURE

A STUDY OF THE DRAINING CAPACITIES OF LONGITUDINAL AND TRANSVERSE TILE DRAINAGE SYSTEMS

(Publication No. 11,896)

Herman Bouwer, Ph.D.
Cornell University, 1955

Transverse and longitudinal drainage systems in homogeneous isotropic soils have been compared with regard to their drainage capacities. From a review of the drainage literature, the diversified opinions on this matter have been presented and the contradictory recommendations for the proper direction of a tile line with respect to the contours have been discussed. Before 1890, it was generally agreed that the longitudinal systems were best, possibly as a result of existing practices with regard to stone drains. After 1890, transverse systems were recommended in the German and British literature, whereas the American literature with a few exceptions remained in favor of the longitudinal system.

In the course of this investigation, distinction has been made between two cases. In the first case the phreatic surface coincided over the entire field with the ground surface (surface runoff impending or already developed). The boundary conditions in this case were fixed and identical, whether the drainage system was transverse or longitudinal. In the second case, the soil was not saturated to the surface of the ground and the phreatic surface could seek its own shape and position. The characteristics of the phreatic surface in a longitudinal system were different from those of the phreatic surface in a transverse system.

The first case (fixed boundaries) was studied by means of a model. Draining capacities of longitudinal and transverse drainage systems were compared at different slopes of the field, different drain spacings and different depths of the impervious layer. The results indicated that no difference in draining capacity exists between identical longitudinal and transverse systems.

The second case (free boundary development) was approached mathematically. Nomographs developed by relaxation methods and relating drain discharges to soil permeability and boundary conditions, and theoretical and empirical curves for phreatic surfaces were used in the calculations. The computations, made for different tile spacings and field slopes, with the impervious layer at great depth, indicated that for the case of free boundary development, identical transverse and longitudinal systems have the same draining capacity. It has been

reasoned that this result also holds if the impervious layer is not at great depth.

The conclusion that there is no difference in draining capacity between longitudinal and transverse systems was based in both cases upon the fact that discharge ratios were scattered around one, without showing any relation with the factors that control the boundaries and the geometry of the flow system.

On the basis of the results recommendations as to the proper direction of a tile line with respect to the contours were made. An oblique system, diverging between 10° and 30° from the contours combines the advantages of both longitudinal and transverse systems and eliminates their disadvantages. It also has an efficient direction in case a continuous movement of ground water downhill during centuries has caused the soil to become anisotropic with the largest permeability in the downhill direction. More research, however, is needed concerning this particular problem.

92 pages. \$1.15. MicA 55-1380

ENGINEERING, CHEMICAL

THE POLARIZATION CHARACTERISTICS OF ALUMINUM AND STAINLESS STEEL IN FUMING NITRIC ACID AND THEIR APPLICATION TO CORROSION, ANODIC PASSIVATION AND CATHODIC PROTECTION

(Publication No. 12,005)

Saul Barron, Ph.D.
The Ohio State University, 1954

Adviser: Webster B. Kay

An investigation was performed on the polarization characteristics of 2S Aluminum and Type 347 Stainless Steel in fuming nitric acid. The resulting data were used to calculate corrosion rates from Faraday's equation and then correlated with those secured from experimental weight loss measurements. The phenomenon of anodic passivity of 2S aluminum was discovered when it was coupled to the inert platinum electrode. Further application of the data and techniques were made to determine the feasibility of applying cathodic protection to stainless steel through impressed currents.

The subject couple was tested in the following environments:

1. White Fuming Nitric Acid (not agitated): 122°F, 140°F, 160°F
2. White Fuming Nitric Acid (agitated): 122°F, 140°F
3. Red Fuming Nitric Acid: 122°F, 130°F

The experimental weight loss measurements were obtained by the use of natural galvanic couples. This couple could be entirely immersed in an environment with the electrical connection completely protected. Polarization tests were performed in a conventional manner by the use of a previously constructed but modified design of salt bridge in series with a saturated calomel half-cell. Cathodic protection tests utilized a special type of finger condenser (in Erlenmeyer flasks) through which steel electrodes could pass. Platinum was the inert electrode.

From the measured potentials, both Pourbaix and Evans types of polarization curves were constructed. The Evans curves provided equipotential points which, when substituted in Faraday's equation gave theoretical maximum corrosion rates for the couple anode member. The cause of anodic passivity is proposed to be due to the formation of an aluminum oxide coating. Experimental tests on cathodic protection of stainless steel provided data on the minimum current densities required to protect it. The following conclusions were reached as a result of this investigation:

1. The metal 2S aluminum corrodes sacrificially to AISI Type 347 stainless steel in white fuming nitric acid, in both agitated and non-agitated solutions.

2. The subject couple behaves similarly in red fuming nitric acid.

3. Increasing the temperature and the current density up to certain values increases the anodic polarization of 2S aluminum, making it less noble. This promotes dissolution of the metal according to Faraday's law.

4. The cathodic polarization of 2S aluminum is unaffected by increase in temperature and current density. No corrosion occurs.

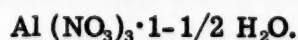
5. Increasing temperature and current density does not affect the anodic polarization of stainless steel. It continues to dissolve rapidly according to Faraday's law.

6. The stainless steel as a cathode polarizes only slightly, is essentially unaffected by changes in temperature and current density in WFNA and RFNA, and does not corrode.

7. Stirring of the electrolyte does not significantly affect the polarizing characteristics of 2S aluminum or 347 stainless steel.

8. The use of the Evans type polarization curves provides equipotential points for the subject couple. These data, when used in Faraday's equation, provide good correlation with corrosion rates obtained from experimentally measured weight losses.

9. At about 140°F, in addition to the hexahydrate of aluminum nitrate, another nitrate of aluminum is formed in the active range, and is probably



10. Anodic passivity of 2S aluminum is manifested at certain current densities and potentials. A marked change involving the formation of aluminum oxide occurs.

11. The aluminum oxide film which causes passivity is insoluble in nitric acid, is highly resistant, transparent, non-porous, and tightly adhering. It is considered to be $\text{Al}_2\text{O}_3\alpha$ or $\text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$.

12. Corrosion of aluminum practically ceases when aluminum becomes passive; alternate cathodic treatments will not reproduce the active state.

13. Cathodic protection, per se, may be readily achieved for stainless steel. The protective current densities were found to be 2 ma./in.² for WFNA at 122°F, 7 ma./in.² for WFNA at 140°F, 10 ma./in.² for WFNA at 160°F, 1.5 ma./in.² for RFNA at 122°F, and 1.5 ma./in.² for RFNA at 130°F.

149 pages. \$1.86. Mic 55-134

STUDIES ON CONTINUOUS REACTOR DESIGN: PART I: GRAPHICAL DESIGN OF CONTINUOUS STIRRED TANK REACTORS. PART II: CONTROL OF CONTINUOUS STIRRED TANK REACTORS.

(Publication No. 11,963)

Olegh Bilous, Ph.D.

University of Minnesota, 1955

Adviser: Edgar L. Piret

Two different aspects of reactor design are considered in this work. In the first part, batch and continuous stirred tank reactor processes are compared from the viewpoint of product compositions. It is found that reactions may be divided into two groups, "simple reactions" for which batch and CSTR processes may be matched to give the same product from a given feed and "complex reactions" for which a CSTR process gives a product different in composition from the batch product.

This distinction is illustrated by plotting the composition of the reacting mixture on a triangular diagram, taking into account only three substances of interest. The reaction paths thus obtained are straight lines for "simple reactions" and are curved for "complex reactions."

It is shown that the usual graphical CSTR design methods are not adequate for the case of complex reactions. A graphical design method, valid for complex reactions and based on the representation of batch data on a triangular diagram is given and illustrated by several examples. This method is especially useful when the design includes recycling, or feed additions along a reactor chain, since material balances are easily represented on the triangular diagram.

The second part of this work is concerned with reactor control. Using complex amplitudes and linearization, different frequency response functions are calculated for a continuous stirred tank reactor. The method includes temperature variations, heat of reaction effects, and may be used with any type of reaction kinetics.

Frequency response functions for concentration and temperature variations are represented on Nyquist polar plots for different numerical examples. It is shown that for exothermic reactions, reactor control may be difficult for certain values of reactor holding time which should thus be avoided in design.

Control quality is discussed for a given example in terms of the response of the controlled system to a unit impulse for controllers of the integral, proportional and derivative types. Finally, an example of the control characteristics for a reaction temperature control loop is worked out on the REAC analogue computer, to illustrate the usefulness of such equipment for reactor control design.

128 pages. \$1.60. MicA 55-1381

A STUDY OF METHODS FOR THE PRODUCTION OF BROMOTRIFLUOROMETHANE AND DIBROMODIFLUOROMETHANE

(Publication No. 12,080)

Charles Richard Finch, Ph.D.
University of Maryland, 1955

Supervisor: Dr. Albert H. Cooper

A review of the methods described in the literature for preparing dibromodifluoromethane and bromotrifluoromethane led to the tentative selection of two of these methods as the better processes for the preparation of the two compounds. It was thought that these two processes, the fluorination of carbon tetrabromide by antimony fluoride and the bromination of a fluorohydrocarbon, would prove to be competitive production methods. This research program selected and studied the fluorination of carbon tetrabromide by antimony fluoride.

Both dibromodifluoromethane and bromotrifluoromethane were prepared in batches by the selected process. Runs at atmospheric pressure gave up to seventy per cent yields of dibromodifluoromethane when based on the charged carbon tetrabromide. By carrying the reaction out in a fractional distillation column, it was possible to take off the volatile dibromodifluoromethane as it formed. These studies showed that the reaction under proper conditions can produce dibromodifluoromethane at a feasible production rate. Next, runs were made at higher pressures to produce bromotrifluoromethane. In one example, at 85 psig, a 44% yield of bromotrifluoromethane was obtained along with a 32.7% yield of dibromodifluoromethane. This batch run was completed in six hours. Since no by-products have been detected in these batch experiments and no loss of carbon tetrabromide due to carbonization has been observed, the yields of a continuous process should surpass 90% because liquid occlusion will not be a factor in a continuous process as it has been in the batch experiments that have been made.

An investigation of the preparation of the essential reactant, carbon tetrabromide, by two methods that appeared to be economical, has been carried out. The reaction of carbon tetrachloride and hydrogen bromide using an aluminum chloride catalyst, proceeded under the simplest of operating conditions, is quite capable of high yields, and can easily be made into a continuous production process. More

economical raw materials are afforded by the preparation of carbon tetrabromide from carbon disulfide and bromine; however, the maximum yield obtained by this method was 23.9%, even though a large excess of bromine was used. A second disadvantage of this latter process is the necessity of separating sulfur continuously and efficiently from the reaction mixture in order that the rate of reaction be not further decreased.

These studies allowed the formulation of a complete flow sheet (to be called Process I) for the production of dibromodifluoromethane and bromotrifluoromethane from carbon tetrachloride, hydrogen bromide, and hydrogen fluoride.

It appeared probable that the direct fluorination of a mixture of carbon disulfide and bromine might be an even more economical method than that of Process I. Batch reaction mixtures of carbon disulfide, bromine, and antimony fluoride gave up to 64% yields of dibromodifluoromethane in approximately 3 hours at atmospheric pressure. At higher pressures some bromotrifluoromethane has been produced, but along with it two compounds boiling at -30°C. and -55 to -57°C. were collected. These compounds were shown to be thiocarbonyl bromofluoride and thiocarbonyl fluoride respectively. Attempts to cause these compounds to react to form either of the desired bromofluoromethanes were unsuccessful, accordingly these compounds must be thought of as by-products of the process and not intermediates.

By operating under conditions which do not favor the formation of the thiocarbonyl compounds, the process appears to be a feasible production method for dibromodifluoromethane. The experiments, so far, show that bromotrifluoromethane cannot be produced directly by the fluorination of carbon disulfide and bromine without also forming a considerable quantity of the thiocarbonyl by-products. If bromotrifluoromethane is desired, it can be prepared by more severe fluorination of dibromodifluoromethane in a second reactor. A flow sheet for this process has been drawn. There is one difficult step in this operation which is the continuous and efficient removal of sulfur.

Using current market prices the cost of raw materials was compared for Process I and Process II. This showed that the raw material costs of Process II were approximately 40% less than those of Process I.

An approximate selling price was determined as \$1.20 per pound of bromotrifluoromethane or dibromodifluoromethane. This price was based on the production of 1,000,000 pounds of dibromodifluoromethane and 1,000,000 pounds of bromotrifluoromethane by the method of Process I. A similar price evaluation was not made on Process II because of the uncertain operations involved; however, it appears probable that the capital cost of Process II will be higher because the process is more complicated than Process I.

It is concluded that Process I is the better method, at least for lower production rates where the capital cost of equipment outweighs the raw material costs. It might be speculated that at higher production rates, Process II could become the more economical, due to the lower raw material costs becoming a factor large

enough to counterbalance the probable higher capital cost of this process.

180 pages. \$2.25. MicA 55-1382

VAPOR-LIQUID EQUILIBRIA IN THE SYSTEM AMMONIA-SULFUR DIOXIDE-WATER

(Publication No. 12,130)

Daniel Taylor Hayden, Ph.D.
University of Washington, 1955

Vapor-liquid equilibrium measurements were carried out for the ammonia-sulfur dioxide-water system over a temperature range of 7 to 60 degrees Centigrade and over a concentration range of 0.03 to 2.3 moles sulfur dioxide per 100 moles of water and 0.03 to 1.4 moles ammonia per 100 moles of water.

An analytical technique was developed to permit analysis of the vapor phase by use of a scintillation counting method whereby the partial vapor pressure of sulfur dioxide labelled with trace amounts of sulfur-35 dioxide could be determined without removal of a sample for analysis. This technique was found to be accurate within five per cent.

Correlating equations, based on solution equilibria in the ammonia-sulfur dioxide-water system, were developed to express the partial vapor pressures of sulfur dioxide and ammonia as functions of total sulfur dioxide and ammonia concentrations and the temperature. Since these equations were found to be impractical to handle, a set of semi-empirical correlating equations were developed, which agreed with most of the experimental data within five per cent.

A procedure, based on the use of mean ionic activity coefficients, was described for correlation of data for the ammonia-sulfur dioxide-water system. This approach may in the future prove of value in predicting results to be expected for comparable systems, such as sodium sulfite-sulfur dioxide-water.

Use was made of a Clausius-Clapeyron equation, together with the correlating expressions, in order to calculate the average molar heats of absorption of sulfur dioxide and ammonia into the solutions over the range of concentrations and temperatures studied. These molar heats of absorption were found to agree with literature values within four per cent.

Practical application of the experimental data obtained for the ammonia-sulfur dioxide-water system has been demonstrated in the design of an absorption tower for the production of ammonia-base bisulfite solution for the delignification of wood. However, it was shown that additional mass transfer data are desirable in order to make the results of the design calculations more reliable.

97 pages. \$1.21. MicA 55-1383

ION EXCHANGE RESIN AS A VAPOR PHASE CATALYST

(Publication No. 12,131)

Arthur John Herrman, Ph.D.
University of Washington, 1955

The heterogeneous vapor phase esterification of acetic acid and ethyl alcohol has been studied using Dowex 50, in its hydrogen ion form, as the catalyst.

The kinetics of the system were studied using a fixed bed upflow technique at 100°, 120° and 140°C. varying the system pressure from 0.217 atmospheres to 1 atmosphere, the feed composition from 25 mole percent to 75 mole percent acetic acid, and the space velocity from 0.033 to 0.25 moles per hour per gram of catalyst.

A modification of the McBain Bakr balance was used to study the adsorption of the individual reactants and products on the same catalyst, at temperatures of 70°C. to 100°C. and pressures of 0.0116 to 0.475 atmospheres.

Mass Transfer resistance through the external particle surface film was shown by calculation and experiment to be negligible within the limits of accuracy of the data. Diffusional resistance through the particle was studied by investigating the effect of particle size upon reaction rate, and was similarly found to be negligible.

Review of prior equilibrium data, and additional gas phase equilibrium data obtained in this work indicates the system ethyl alcohol, acetic acid, ethyl acetate and water is complex, and does not obey ideal gas laws under the conditions investigated. The existence of an acetic acid vapor trimer, as well as monomer and dimer, is postulated, based upon published data. Experimentally, water vapor is shown to associate with both ethyl alcohol acetic acid vapors. It is believed this complexity is largely responsible for the pressure dependence of the reaction rate constant and the equilibrium constant.

The mechanism of the heterogeneous reaction is proposed and the adsorption constants empirically obtained from the kinetic data are compared with those determined by direct measurement of the pure component on Dowex 50. Ethyl alcohol and water were found to be adsorbed on Dowex 50 under the conditions used in the kinetic experiments. Acetic acid was slightly adsorbed and ethyl acetate was not adsorbed. The ethyl alcohol adsorption constants obtained by direct measurements compared very favorably with those obtained from the kinetic data. Predetermined adsorption data were found to be extremely useful in the formulation of the rate controlling mechanism.

The kinetics of the heterogeneous esterification reaction was found to be surface reaction rate controlling, both reactants adsorbed. This mechanism fits the data with reasonable accuracy over the entire range of experimental conditions.

133 pages. \$1.66. MicA 55-1384

EQUILIBRIUM STUDIES OF THE SYSTEM $\text{Na}_2\text{O}-\text{CO}_2-\text{H}_2\text{S}-\text{H}_2\text{O}$

(Publication No. 12,132)

Klaus Ludwig Mai, Ph.D.
University of Washington, 1954

To facilitate vapor liquid equilibrium measurements of the system $\text{Na}_2\text{O}-\text{CO}_2-\text{H}_2\text{S}-\text{H}_2\text{O}$ over a temperature range of 20° to 65°C , a pressure range of 50 to 3500 mm Hg, and a sodium ion concentration range of 0.10 to 1.00 N, analytical techniques were developed for the continuous analysis of the liquid and vapor phases. These techniques involved a scintillation counting method whereby the partial pressure of hydrogen sulfide tagged with sulfur-35 could be determined continuously in the vapor phase, and pH and conductance measurements which, coupled with the use of given calibration diagrams, allowed a continuous indication of the ratio of sodium carbonate, sodium bicarbonate, and sodium hydrosulfide in solution in the liquid phase.

The equilibrium constants which were experimentally obtained by an application of these analytical methods were found to be reproducible to within three per cent. Enthalpy changes accompanying reactions within this system were calculated from the temperature relation of these constants. They were found to be within an average of six percent of the enthalpy changes estimated from published heats of formation.

By treating these equilibrium constants statistically, empirical correlations were derived which express them as functions of temperature and sodium ion concentration. These correlating equations were shown to predict all available experimental data to within four per cent and present a notable improvement over the correlating equation by Harte and co-workers (19), which gives values which disagree by as much as 73.5 per cent.

The application of these correlating equations to the design of industrial equipment for the carbonation of sodium carbonate-sodium sulfide brines was demonstrated. The necessity of additional data on the kinetic and mass transfer characteristics of this system was pointed out.

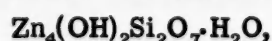
117 pages. \$1.46. MicA 55-1385

FLOTATION OF ZINC SILICATE BY N-OCTYL METHYLENE BLUE

(Publication No. 12,145)

Malvern Frank Obrecht, Ph.D.
Michigan State University, 1952

The application of n-octyl methylene blue as a collector for the flotation of zinc silicate was investigated. This study was carried out on three zinc silicate ores, namely, (1) Willemite Zn_2SiO_4 , (2) Calamine or Hemimorphite, $\text{Zn}_2(\text{OH})_2\text{SiO}_3$ or



(3) A commercial Los Lamentos ore, a tested zinc silicate from Mexico.

The collector was synthesized by preparing a modified dye which was known to mordant zinc salts. The inability to modify methylene blue directly required extensive organic synthesis, including the preparation of ortho n-octyl dimethyl aniline which was used to prepare the compound called n-octyl methylene blue.

The flotation tests were carried out on a feed consisting of from 1% to 6% zinc with the majority of the gangue material being silicious. Reflotation of the concentrate was also investigated. In both studies, a 100 gram batch type flotation cell was employed. Under the test conditions used it was found that n-octyl methylene blue functions as a selective collector for zinc flotation. Reflotation of the concentrate produced an improved cut.

The modified dye appears to offer a new approach to the flotation of zinc silicate. It is theorized that selectivity for zinc silicate of the modified dye is due to the mordant action of the zinc atoms in the atomic lattice of the zinc silicate, further, that the zinc silicate particles are "Enveloped" by the dye molecules.

It is demonstrated that the factors of pH, particle size, and the amount of collector affect the percent zinc in the concentrate, percent recovery of zinc, enrichment of the product, and the improvement factor in the flotation of zinc silicate by n-octyl methylene blue. Certain trends are shown to exist for these factors, and under the conditions of the test "optimums" appear to exist for the zinc silicate ores studied.

The commercial synthesis of n-octyl methylene blue is not practical. However, the approach using this compound as a collector, is fully justified by our present knowledge of dye mordants as well as the presently developed theory of surface chemistry relative to mineral flotation.

117 pages. \$1.46. MicA 55-1386

ABSORPTION OF HYDROCARBONS OF HIGH VOLATILITY IN HYDROCARBON DROPS

(Publication No. 12,093)

Tarik Galip Somer, Ph.D.
University of Maryland, 1955

Supervisor: Donald T. Bonney

Among the articles published about the absorption of gases by liquid drops, there seemed to be no general agreement on the mechanism of the mass-transfer. The majority of the workers investigated the absorption of carbon dioxide, a slightly soluble gas, by water drops using practically the same type of apparatus in which the drops were collected under a layer of kerosene. The solubility of carbon dioxide in kerosene was believed to be the main factor causing large deviations in the quantitative results.

By following a different procedure, the absorption of a highly soluble gas, n-butane, in an absorbent oil was investigated. The study included the absorption

by drops during formation, fall and in their stationary state. Additional studies have been made to determine the solubility rates of the high volatility hydrocarbons by molecular diffusion on the flat surfaces of the absorbents to estimate, by comparison, the intensity of turbulence during the formation and the fall of the drops.

Some of the significant results can be outlined as follows:

(a) Absorption During the Formation of Drops:

The over-all mass-transfer coefficient, K_g , in the units of ml. n-butane (STP) per sec.-sq. cm.-atm., could be correlated by the following empirical equation:

$$\frac{K_g}{W} = \frac{1.86}{D^{2.57} - 0.016 D^{1.39} \theta_f}$$

where W: weight of drop, gm.
D: external diameter of tip, cm.
 θ_f : time of formation, sec.

The final concentration on n-butane was found to be directly proportional to the time of formation and inversely to $D^{1.18}$.

The internal diameter of the capillary tips showed practically no effect on the ratio K_g/W .

The mechanism of mass-transfer at this stage is concluded to be an eddy diffusion in the presence of the violent mixing, which starts at the center of the drop by the entrance of fresh liquid and gradually decreases towards the outer surface.

(b) Absorption During the Fall of the Drops:

Having allowed the drops of various sizes to fall through a distance of 131 cm., it was found that the transfer coefficients were five to thirteen times higher than those of the formation period. The time of formation before the start of fall showed no appreciable effect on the transfer coefficients, and it was concluded that the controlling mechanism of the mass-transfer at this stage was not a molecular diffusion but an eddy diffusion as a result of turbulence on the outer surface of the drops. This was due to skin friction and the drag forces distributed unevenly, causing periodic oscillations. The increase of the transfer coefficients with the increasing size of drops was apparent, indicating that the intensity of turbulence is greater for the drops having larger surface areas.

It could be stated that the turbulence on the outer surface of the drops is much greater during the fall than during the formation period.

(c) Absorption by Stationary Drops:

The droplets of the absorbent (lube oil SAE 30) were distributed within a bundle of glass fibers, which was packed into an absorption column. Each of six types of hydrocarbons of high volatility from propane to iso-pentane was introduced into the column at two minute intervals. The extent of saturation within this period of time was 100% for propane, but decreased for heavier hydrocarbons; for instance, it was about 74.5% for iso-pentane.

The rate of absorption of n-butane indicated that, the absorbent was about 54.8% saturated in the first fifteen seconds, reaching 76.1% in thirty minutes.

The main advantage of distributing the absorbent in the form of droplets was the obtaining of a high surface-to-volume ratio. An approximate calculation showed that, to possess the same ratio, the liquid would have to be spread as a film to a thickness of 0.4 mm. 151 pages. \$1.89. MicA 55-1387

SHEAR DEGRADATION
OF POLYSTYRENE SOLUTIONS

(Publication No. 12,287)

Alfred Martin Turkel, Ph.D.
Cornell University, 1955

The mechanical degradation of high molecular weight polystyrene dissolved in nitration grade benzene was studied. The degradation was effected by passing the polystyrene solutions through a shearing zone existing in the space between a rotating disc and a matching stator. The use of high speeds and low clearances produced high rates of shear.

At a given rate of shear there is a critical molecular weight above which the molecular chain is ruptured. This critical molecular weight depends upon rate of shear and is independent of concentration over a range of 0.275 to 1.65 grams/deciliter. The relationship between critical molecular weight and rate of shear over a range of 30,000 to 140,000 seconds⁻¹ is:

$$R + 2.07 R M_c \times 10^{-7} + 0.0128 M_c = 296,000$$

where M_c = critical molecular weight

R = rate of shear, seconds⁻¹.

107 pages. \$1.34. MicA 55-1388

ENGINEERING, CIVIL

STRESSES AND DEFLECTIONS IN
REINFORCED CONCRETE SHEAR WALLS
CONTAINING RECTANGULAR OPENINGS

(Publication No. 11,640)

Robert Humphrey Stivers, Ph.D.
Stanford University, 1955

Shear walls are important components of most building structures. The main function of shear walls is to resist lateral loads and transfer them from story to story. It is necessary to have a thorough knowledge of the action of these walls in order to insure their proper design. The problem involves rectangular reinforced concrete shear walls of any proportions and containing any number of rectangular

openings. Furthermore, the walls may be bounded by any size beams, columns, face walls, or foundations. Lateral loads on buildings are caused by wind, earthquakes, and blasts. Since the lateral loads can become very large, it is necessary to be able to predict the behavior of shear walls throughout both the elastic and inelastic ranges of action. This involves the prediction of the elastic deflection, the load at first crack, the ultimate load, the deflection at ultimate, and the deflection following ultimate.

The shear wall is essentially a plate loaded in its own plane. The problem is first approached on the basis of the lattice analogy, which is an elastic solution. Complete derivations are given. The lattice analogy is very accurate in the elastic range, but involves a considerable amount of labor. Therefore it is used on four trial walls as a basis for comparison of more simple methods. The four other methods used are the Portland Cement Association Method, complete elementary theory, frame analogy, and approximate frame analogy. The Portland Cement Association method assumes that the entire wall deflection occurs in the areas between openings. The deflections are calculated by elementary strength of materials formulas. The complete elementary theory is an extension of the Portland Cement Association method to include the remaining wall areas and introduces the effect of rotation. The frame analogy involves the replacement of the wall by a rigid frame and solving by ordinary frame methods. The approximate frame assumes the far ends of all frame members to be fixed, and results in some simple equations. The four methods are then compared on the basis of eleven experimental test walls.

For the solution in the elastic range, the method which best combines simplicity with accuracy is complete elementary theory. This method is used for calculating the elastic deflection and the shear load at which the first wall cracking occurs.

The ultimate strength of a wall is found to be the sum of the strengths of the individual areas between openings. The bending and shearing strengths of each of these areas are computed from empirical equations.

The deflection at the ultimate load is approximately five times the deflection which would occur at ultimate if the wall continued to act elastically after cracking. Large deflections take place without appreciable change in load following ultimate.

238 pages. \$2.98. MicA 55-1389

LATERAL SUPPORT FORCES ON BEAMS AND COLUMNS

(Publication No. 11,925)

William Zuk, Ph.D.
Cornell University, 1955

Little is quantitatively known about the lateral forces that are induced in a slightly crooked column or beam which has one or more lateral supports

between the ends of the member. To obtain some representative results, eight cases of lateral support forces on beams and columns are considered.

- Case I Columns with an immovable lateral support at the center
- Case II Columns with a continuous immovable support
- Case III Columns with an elastic support at the center
- Case IV Columns with a continuous elastic support
- Case V Beams with an immovable lateral support at the center
- Case VI Beams with a continuous immovable support
- Case VII Beams with an elastic support at the center
- Case VIII Beams with a continuous elastic support

The solutions in cases I & II are obtained by the direct use of differential equations. Cases III & IV have been previously solved by the energy method in other literature and are presented in this thesis only for comparison and completeness. Cases IV & V are solved by the direct use of fourth order differential equations. Cases VII & VIII are solved by the use of the Rayleigh-Ritz energy method, involving Fourier series.

In all cases, the lateral force is presented as a function of the applied force or moment and the column or beam constants. Also, wherever possible, the induced lateral force is reduced to terms of column or beam constants by replacing the arbitrary applied load with its maximum or buckling value. This thus furnishes the maximum lateral force.

A numerical evaluation of standard beams and columns reveals that such maximum lateral forces are relatively small and of the order of one percent of the critical buckling load of columns or critical buckling moment of beams divided by the beam depth.

Other numerical examples of actual building frames show that since these bracing forces are relatively small, even weak and elastic bracing is effective.

80 pages. \$1.00. MicA 55-1390

ENGINEERING, ELECTRICAL

R-C NETWORK SYNTHESIS

(Publication No. 11,922)

Hun Hsuan Sun, Ph.D.
Cornell University, 1955

The purpose of this study is to develop a method of synthesizing a circuit having a given transfer function with poles restricted to the negative real axis and zeros unrestricted in the complex frequency plane. The synthesized circuit is a linear passive network containing only resistances and capacitances and

having the least number of elements. In general, the synthesized network contains two R-C ladders with their inputs in parallel, and their outputs connected to an additional R-C ladder through an ideal transformer.

Part I presents a method of resolving the given transfer function into the difference of two functions having zeros on the negative real axis of the complex frequency plane. Actually the numerator polynomial is resolved into two polynomials, the denominator is left unchanged. The method is based on collinear conditions for points representing the coefficients of n -th degree polynomials in a space of n dimensions. The development of the concept of representing an n -th degree polynomial by points in n -dimensional space leads to the resolution of a polynomial into the difference of two polynomials containing only negative real zeros. A definite procedure is outlined for the application of this method of resolution and examples are given to illustrate the steps. The two component polynomials of the given transfer function are then synthesized into two R-C ladder networks containing the least number of elements. The two ladders are paralleled through an ideal transformer terminated either by a unity resistance or by an R-C ladder, depending on the values of the zeros of the given transfer function.

If, instead of the difference, the sum of two polynomials is to be used; then more than two component polynomials may be required. Means are given for the determination of the upper bound of the minimum number of components whose zeros are all negative and whose sum is equal to the given polynomial. The minimum number has a lowest bound equal to two and an upper bound equal to the least integer greater than $n/2$, where n is the degree of the numerator polynomial in the given transfer function.

Part II discusses a unique and direct method to determine whether or not the zeros of a given polynomial are all real and negative. It is derived from an expansion theorem for the Stieljes' continued fraction. A summary of the continued-fraction theorems, developed by Stieljes, Van Vleck, Frank and Wall is included. A criterion for the negative distinct real zeros is derived from the algorithm procedures for expanding a rational fraction into even or odd convergences of the Stieljes' continued fraction. This criterion is applied to polynomials of the second and third degrees. An example is worked out involving a polynomial of the 5th degree to show that the criterion is true for polynomials having a degree higher than the fourth.

The thesis concludes with an illustrative example. The problem involves a rational function with numerator and denominator of the 5th degree and of the seventh degree respectively. The numerator has negative coefficients in order to ensure a wide dispersion of its zeros in the complex frequency plane. The resulting network contains twenty-eight elements.

116 pages. \$1.45. MicA 55-1391

ENGINEERING, HYDRAULIC

MOTION OF A SPHERICAL PARTICLE IN THE ACCELERATED PORTION OF FREE FALL

(Publication No. 12,113)

Robert Wardlaw Moorman, Ph.D.
State University of Iowa, 1955

Chairman: Professor John S. McNown

In spite of the considerable efforts devoted to the study of free fall at a sphere through a fluid, little has been accomplished to define the accelerated portion of such motion. Previous investigators have not considered thoroughly the effects of all physical variables related to the problem, and they have limited themselves to relatively high values of the terminal Reynolds numbers. This research provides a systematic study of the phenomenon within the range of terminal Reynolds numbers between 1 and 2000 and for ratios of the density of the sphere to the density of the liquid between 1.2 and 9.

The concepts of fluid resistance and virtual mass are discussed, and several analytical solutions based upon these interpretations are presented. Within the range of very slow motion, an exact solution developed by others is particularly noteworthy. This solution is based upon the linearization of the Navier-Stokes equation by disregarding the terms involving squares and products of velocities, and its interpretation reveals rather startling oscillations at the velocity-time curve. Less rigorous solutions are completed using the resistance forces of uniform motion. Whether these treatments are oversimplified and through what range they can be extended can only be ascertained experimentally.

The general technique employed in collecting data was a photographic one. Successive positions of a sphere were recorded on a photographic plate, the field of motion being illuminated by a stroboscopic light source and the shutter of the camera remaining open throughout a run. The steps taken to insure reasonable accuracy in the evaluation of all physical variables are pointed out in detail.

The results are indicated graphically. Velocity-time curves in dimensionless form are presented for each of four ratios of the density of the solid to that of the liquid. The several curves show pronounced similarities in mean slope and conformation, none showing the oscillations predicted by the exact solution for very slow motion. In fact, the entire data fall on a single smooth curve upon adjustment of the dimensionless time scale. This curve is described mathematically from one analytical approach, the basis of which is the evaluation of the resistance force as a first power function of the velocity of the sphere. This resistance law is at variance with that which was assumed by previous investigators of this case of motion. It is apparent that the instantaneous Reynolds number is not the sole criterion for describing the type of fluid flow around a sphere which is in the accelerated portion of free fall, and consequently the resistance forces of uniform flow are not descriptive

of this case. The equation of the single curve and one additional plotted function which is presented enable one to predict future occurrences within the range of variables investigated.

61 pages. \$1.00. MicA 55-1392

ENGINEERING, MECHANICAL

HEAT TRANSFER TO BOILING WATER INSIDE TUBES WITH FORCED CIRCULATION

(Publication No. 12,165)

Shih-Yuan Chen, Ph.D.
The Ohio State University, 1955

Despite the wide industrial application of boiling heat transfer phenomena over a period of many years, the basic boiling heat transfer and its fluid flow phenomena are not yet fully understood. Recently many investigators have concentrated their attention on surface boiling heat transfer. These investigations stemmed from the desire to use water as a medium in the heat exchanger of nuclear reactors, in liquid-cooled rocket motors, etc. It is specially important to secure an accurate formula for designing heat exchangers for nucleate propulsion aircraft.

The purpose of this work is to develop a correlating equation based on the existing boiling heat transfer data. An extensive discussion of factors affecting boiling heat transfer is presented. It is found that pressure, fluid velocity, and velocity induced by vapor bubbles play the major roles in the mechanism of boiling heat transfer. A mathematical analysis included in this work results in an equation having the same variables as the correlating equations and an identical form.

The correlation shows that for $15 \leq p \leq 150$ psia, the following formula can be used:

$$\frac{q}{A} \times \frac{L}{D} = 4.428 \times 10^{-3} V_B^{1.025} P^{0.9073}$$

and for $150 \leq p \leq 2500$ psia the data is correlated by

$$\frac{q}{A} \times \frac{L}{D} = 4.428 \times 10^{-3} V_B^{1.025} P^{0.9073} - 7.93 \times 10^{-6} P^{1.219} G^{1.053}$$

Where

$\frac{q}{A}$ = heat flux in Btu/sec.sq.in.

$\frac{L}{D}$ = ratio of length to inside diameter

P = fluid pressure in psia

G = mass flow rate in lb./sec.sq.ft.

V_B = boiling velocity in fps

$$= V_f G + \frac{q}{A} \times \frac{V_{fg}}{h_{fg}} \times \frac{A}{A_c} \times 144$$

V_f = specific volume of saturated liquid in ft.³/lb.

V_{fg} = specific volume of evaporation in ft.³/lb.

A_c = flow area in sq. inches.

h_{fg} = enthalpy of evaporation in Btu/lb.

A = heat transfer area in sq. inches.

193 pages. \$2.41. MicA 55-1393

A METHOD FOR THE DESIGN OF NON-STANDARD INVOLUTE SPUR GEARS

(Publication No. 11,908)

Frank William Kinsman, Ph.D.
Cornell University, 1955

Certain forms of involute spur gear teeth have been standardized by the American Standards Association. However, it is sometimes desirable to use non-standard involute spur gears in order to mesh gears at non-standard center distances, or to improve the strength of the gear teeth. This thesis presents procedures which may be used for the design of those non-standard spur gears which can be generated by using standard hobs or pinion cutters at non-standard generating dimensions.

In writing this thesis the investigator accomplished four objectives. They were:

1. The determination of the practical limits for hob and pinion cutter offsets.
2. The preparation of charts showing the effect of various hob and pinion cutter offsets on the beam and surface strength of the resulting gear teeth.
3. The classification of the various types of non-standard involute spur gear design problems.
4. The presentation of a logical design procedure for each of the four types of non-standard gear problems, without departing from accepted gear design methods.

The thesis is divided into three sections, which are "Fundamental Considerations," "The Design of Non-standard Spur Gears Generated with Hobs or Rack Type Cutters," and "The Use of Pinion Cutters to Generate Non-standard Gears." The first section consists of three chapters which discuss the kinematic requirements for spur gears, the importance of the involute form of tooth, and the mechanical requirements for gear teeth. The design procedures introduced in this thesis are unique in that although they utilize the accepted Hertz and Lewis equations, no mention is made of numbers of teeth nor diametral pitch until the gear materials and face widths have been selected. Once these have been selected on the basis of adequate surface strength, the number of teeth in the pinion and gear are selected so that the teeth in the pinion and gear will have adequate beam strength.

The second section of the thesis (Chapters 4 through 8) is concerned with non-standard gears generated with hobs or rack type cutters. In Chapter 4 the effect of hob offset on the form of gear teeth is

explained, and the formulas for generating teeth to mesh at non-standard center distances are given. The practical limits to hob offsets are determined by mathematical methods. Methods for comparing the strength of non-standard gear teeth are shown.

Chapter 5 is a discussion of long and short addendum gears; that is, gears which run at center distances which are standard for their total number of teeth, but whose pinion teeth are thicker than standard and whose gear teeth are thinner than standard. The system is used to improve the strength of the pinion teeth and the contact ratio of the drive. A design procedure is shown which utilizes the design charts developed in the thesis. The next chapter gives a design procedure for using the extended center distance system to strengthen gear teeth. The limitations of this system are described, and a design procedure is developed for this important class of non-standard gears.

Chapters 7 and 8 are concerned with the design of non-standard gears to mesh with standard gears, and with the design of gears to mesh at non-standard center distances. In each chapter specific design procedures are given for determining the hob offsets, materials, and face width for the gears.

The final section of the thesis covers the same topics as the second section, except that in the final section the gears are assumed to be generated with pinion cutters instead of by hobbing, and the corresponding procedures and equations are developed.

170 pages. \$2.13. MicA 55-1394

equations to arrive at the velocity of propagation of the various modes. Curves of the group velocity versus wave length for the first three anti-symmetric modes are given.

The experimental determination of the velocity of propagation of a disturbance produced by a transverse impact was conducted using a steel bar of one inch by one inch cross section. The outputs of two resistance strain gages attached to the outer fibers at two different stations along the beam were displayed simultaneously on an oscilloscope screen. By calibrating the horizontal sweep of the scope, the time required for the disturbance to travel the distance between the two stations was measured.

The measured velocity of propagation was, within experimental error, the maximum velocity given by the theoretical calculation for the first anti-symmetric mode. No evidence was obtained that any of the energy of the transverse impact went into the higher modes. From physical considerations, it would be expected that most of the energy would go into the simplest mode, which is in this case the first one.

The number of modes which are excited by an impact and the amount of energy which will go into the different modes depends on the nature of the impact. With the curves given, information can be obtained from experimental data. When a disturbance suddenly appears on the experimental results a maximum velocity of propagation is indicated, and the disappearance of a disturbance is indicative of a minimum velocity. The frequency of the disturbance serves as a cross-check to determine the proper mode when two modes have the same propagation velocity.

38 pages. \$1.00. MicA 55-1395

ENGINEERING MECHANICS

VELOCITY OF PROPAGATION OF BENDING WAVES IN LONG RECTANGULAR BEAMS

(Publication No. 11,899)

Harold Lewis Dibble, Ph.D.
Cornell University, 1955

This is a theoretical and experimental study of the velocity of propagation of bending waves due to a transverse impact on a rectangular beam. The energy due to a sudden impact on a beam is propagated in an infinite number of different modes which are characterized by their longitudinal stress distribution. The term "bending wave" refers to those modes which have anti-symmetric longitudinal stress patterns.

The theoretical investigation is based on the equations of elasticity for plane stress and plane strain. A solution in the form of a plane straight crested wave of wave length λ , propagating with a velocity, c , is assumed and substituted in the equations of elasticity. When this solution is required to satisfy the boundary conditions, a transcendental equation relating c and λ results. The concept of group velocity is then applied to the solutions of the transcendental

BENDING WITH AXIAL FORCE OF BARS IN PLASTICITY

(Publication No. 12,265)

Donald Howard Garbaccio, Ph.D.
Stanford University, 1955

In recent years considerable interest has developed in deformations sufficiently large to involve plastic flow of structural elements. One of the problems which has attracted interest is that of bending with axial force. Both tensile and compressive axial loads have been considered. This thesis considers both types of loading for bars of materials which exhibit linear strain hardening above the yield point.

The bending moment and axial force are written with the depth of plastic deformation and the position of the neutral axis as parameters. By eliminating the position of the neutral axis, interaction relations are written with the depth of plastic deformation as parameter for rectangular, elliptical, and I sections. Methods for estimating deflections in the elasto-plastic range are presented as they are necessary in designing by means of interaction curves. Because of the stability problem involved with compressive loading, the work on interaction curves and their use is limited to tensile loads.

The buckling of eccentrically loaded rectangular columns under compression is treated by using Newmark's numerical method. The moment-curvature relation, which is needed in applying Newmark's method, is written by relating the curvature to the depth of plastic deformation and the position of the neutral axis. Column curves are presented for use in the design of columns.

It is found that when the slope of the strain hardening portion of the stress-strain diagram is small, the relation between deflection and depth of plastic deformation is nearly linear. This makes it possible to write an approximate differential equation for the deflection curve in the elasto-plastic range. The solution of this equation is approximated by assuming the deflection curve to have the form of a half sine wave. Comparison of the column curves found by this method shows good agreement with those found

by using Newmark's method, and the saving in time is considerable using the approximate method.

The problem of nonsymmetrical bending with axial force of rectangular bars is also treated. Because the expressions for bending moments and axial force are so cumbersome, the treatment is restricted to the perfectly plastic material. The change in shape of the core of the cross section is shown for elasto-plastic deformation. The rotation of the neutral axis from the elastic to the fully plastic state is shown. It is demonstrated that the ratio of the ultimate bending moment to yield moment changes with the orientation of the loading plane in the section and that this ratio may be greater for loads not in a plane of symmetry than for loads in a plane of symmetry.

94 pages. \$1.18. MicA 55-1396

FINE ARTS

THE ARCHITECTURE OF ISLAMIC IRAN: THE IL KHĀNID PERIOD

(Publication No. 11,059)

Donald Newton Wilber, Ph.D.
Princeton University, 1949

This study of architecture in Iran during one very important period of some two hundred years in the long history of that country is the outgrowth of a number of years of travel and exploration throughout Iran in the course of which many unknown or little known structures were measured, planned and recorded in details. The purpose of the study is to demonstrate that the widely distributed monuments erected in Iran during the thirteenth and fourteenth centuries do comprise a distinctive series with characteristics peculiar to the Il Khānid period.

The first part of the study is a history of Iran under the Il Khāns - the Mongol rulers of the land - and the material was chosen to have an intimate relationship with the architecture of this time and hence includes all specific references to constructional activity that have been gathered in the course of extensive reading in Arabic and Persian sources and European compilations. Stress is placed upon the force and continuity of Iranian culture which proved strong enough to convert the Mongol conquerors and devastators of the country; first, to the Moslem faith and, second, to become such ardent patrons of the arts that the early fourteenth century was a time of high cultural achievement. Secondary emphasis is placed upon the relations between the Mongol Il Khāns and the European rulers of the time.

The second part establishes the style of the architecture of the period. The monuments, in their entirety, are presented as a single stage in the continuous historical development of architecture in Iran. General conclusions are drawn relative to the

major features of the architecture and its distinctive character, to the classes of structures erected and to the relation of the structures to their sites. A section examines the materials of construction which were in use and takes up the problem of whether the monuments were erected from prepared plans or by the methods of traditional craftsmanship. The decoration of the structures is considered in relation to materials, patterns and methods of execution. The various elements of construction are then detailed and a section dealing with important features of design follows. This latter section indicates that the tendency of the period toward emphasizing verticality and toward the lightening of the fabric parallels the change which took place in Mediaeval Europe during the transformation of Romanesque to Gothic style. This part closes with an examination of two distinctive regional schools of architecture.

The third part, the longest of the study, comprises a catalogue description of some one hundred and nine monuments. The more important structures are described in considerable detail, from observations made in the field, while the others are treated by a summary statement. The importance of this part lies in the fact that most of these structures have received no prior notice of a serious nature. The fourth part is a list of structures, important at the time of their construction, which have completely vanished.

The fifth part consists of a bibliography of over three hundred titles and includes all the material used in the preparation of the first part of the study as well as all the titles listed as references in the third part.

The sixth part consists of one hundred and eighty photographs of the monuments described in the catalogue. The seventh part comprises some 58 drawings, including maps, sketches, plans, elevations and sections. Most of the plans have not been published.

279 pages. \$3.49. MicA 55-1397

FOOD TECHNOLOGY

THE EFFECT OF PROCESSING METHODS ON THE COLOR OF CANNED TOMATO JUICE

(Publication No. 12,018)

Rees Basil Davis, Ph.D.
The Ohio State University, 1954

Adviser: Wilbur A. Gould

In this study, canned tomato juice was manufactured in the pilot plant at The Ohio State University, using the Rutgers variety of tomatoes during the 1950, 1951 and 1952 seasons. The effects of processing methods on the color of tomato juice were evaluated. "Cold-break" and "hot-break" methods of extraction were compared. In addition, short-time-high-temperature heat pasteurization was compared with conventional retort sterilization for preservation purposes. A limited number of lots were also processed by the "hot-break" process using a vibrating screen following the pre-heater, to evaluate its effect on the color of tomato juice. Furthermore, for each of the above processes, the effect of storage on canned tomato juice color was studied.

Color was measured objectively by means of the Hunter Color and Color-Difference Meter in terms of Hunter L, a_L and b_L readings. These readings were then converted to Munsell hue, value and chroma renotations by appropriate graphs and calculations. In these studies, Munsell hue and chroma renotations were also corrected for Munsell value. The effect of processing on the color of tomato juice was then evaluated in terms of Munsell hue, value and chroma, and these three attributes of color were also compared with official U.S. Department of Agriculture color scores assigned the finished product, since color scores of canned tomato juice are officially established by comparison with Munsell spinning disks of specified Munsell hue, value and chroma.

The following conclusions were made concerning the effects of processing methods on the color of canned tomato juice:

The three attributes of the Munsell color system (hue, value and chroma) must be taken into consideration when evaluating visually perceptible differences in the color of raw or canned tomato juice.

When the raw extracted tomato juice of equivalent raw product color was classified in terms of the three attributes of the Munsell color system (hue, value and chroma), there was little difference among the various processes used in this study in their effect on the color of canned tomato juice.

When classifying the raw product on the basis of the U.S.D.A. color score of the finished product, it was possible to propose color specifications from Hunter Color and Color-Difference Meter data for Munsell spinning disks in terms of Munsell hue, value and chroma renotations for the raw product (extracted

unheated juice; blender sample for the "cold-break" two extraction plate-pasteurized process and chopper sample for the "hot-break" plate-pasteurized process) in order to predict the following color grades of canned tomato juice: High U.S. Grade A for color (28-30 points), 8.7R 2.66/6.3 (Hunter L = 22.9, a_L = +20.6 and b_L = +9.0); Low U.S. Grade A for color (26-27.9 points), 9.5R 2.72/6.2 (Hunter L = 23.3, a_L = +19.5 and b_L = +9.3); and U.S. Grade C for color (23-25.9 points), 0.3YR 2.95/5.6 (Hunter L = 25.2, a_L = +17.6 and b_L = +9.9).

In general, ten months' storage had little effect on the color of canned tomato juice regardless of the processing methods used, either in terms of Munsell hue, value and chroma renotations or the U.S.D.A. color scores of the finished product.

178 pages. \$2.23. Mic 55-135

SOME FACTORS AFFECTING THE QUALITY OF PRE-PEELED POTATOES

(Publication No. 11,903)

William Smith Greig, Ph.D.
Cornell University, 1955

Investigations were conducted on pre-peeled potato quality including French-fry quality, after-cooking darkening, and length of storage life of the treated product. In these tests the commonly used pre-peeling treatment of a sodium bisulfite dip was used as a standard or "check" treatment.

French Fry Quality: The effect on French-fry color of storage temperature of the whole untreated potatoes, the effect of specific gravity, variety, and chemical treatments were measured objectively. The effects of the necessary low temperature storage for the treated product on French-fry color was also determined. Storage of the treated potatoes at 40°F. resulted in darker fried potatoes than storage at 32°F. Increasing the length of storage at these temperatures resulted in increasingly darker fried potatoes.

The oil content of fried potatoes was found to vary with the surface area per unit of weight. A highly significant linear difference was found between oil content and specific gravity differences. The higher the specific gravity of the tubers, the less the oil content.

After-cooking Darkening: Tests of pre-peeling dips to prevent after-cooking darkening were conducted.

Acids were not satisfactory. Sodium acid pyrophosphate reduced but would not prevent darkening. This discoloration was commercially controlled using the sodium salts of ethylenediamine tetraacetic acid in conjunction with sodium bisulfite as a pre-peeling dip.

Storage Life of Pre-Peeled Potatoes: The effects of

specific gravity, variety, storage temperature, packaging materials, and storage in light versus dark on the storage life of pre-peeled potatoes were determined. Mold inhibitors or bacteriostatic agents incorporated into a pre-peeling treatment did not increase storage life. Many melanin inhibiting chemicals were tested. An increase in storage life of 3 days or more, at temperatures about 50°F., were obtained by adding 1 percent of a sodium salt of ethylenediamine tetraacetic acid to the standard bisulfite treatment.

Summary: Many factors affecting the quality of pre-peeled potatoes were investigated, and a new chemical treatment is recommended. This is a mixture of

sodium bisulfite at concentrations from 1 to 1.5 percent and approximately 1 percent of the di-, tri-, or tetra sodium salt of ethylenediamine tetraacetic acid as a one minute dip for peeled potatoes. This mixture prevents after-cooking darkening, gives a longer storage life to the peeled potatoes (at relatively low temperatures), and to a large degree prevents blistering of the fried product. The effectiveness of ethylenediamine tetraacetic acid, in preventing both enzymatic darkening of the peeled product and after-cooking darkening, is in agreement with the presently accepted theories as to the causes of these two separate systems of discoloration in potatoes.

187 pages. \$2.34. MicA 55-1398

GEOGRAPHY

LAND UTILIZATION IN THE NEW AND WATAUGA RIVER BASINS OF NORTH CAROLINA

(Publication No. 12,006)

Edgar Bingham, Ph.D.
The Ohio State University, 1954

Adviser: Roderick Peattie

The valleys of the upper New and Watauga rivers of North Carolina make up a segment of one of the most rapidly changing areas of the United States, a region culturally static up to the present generation. This is the Southern Appalachian Mountain region. Although the character and magnitude of change vary greatly from place to place within the region, the factors responsible for it and those resisting it are essentially the same in all areas.

Inaccessibility has always been the greatest obstacle to cultural advancement in the New-Watauga area, and the first major changes in land use came only after the region had been penetrated by transportation facilities. The most important of these were the highways, which were greatly improved and expanded in the period between 1920 and 1930.

The highways opened to the New-Watauga region markets for many products long common to the area and offered commercial possibilities for many new products as well. However, commercialization did not take place at once. An inherent fear of change served as a retarding factor. Also influential were the lack of capital and the general ignorance of the people concerning commercial possibilities. These factors, combined with the restrictive elements of the physical environment, caused commercialization to proceed with caution and along special lines. The subsistence economy had been so long established in the region that it gave way slowly to commercial production and seldom completely. Small-scale experimentation was characteristic of early commercial activities.

The first important commercial expansion took

place in agriculture, featuring products already important in subsistence such as potatoes and cabbage. As information concerning the production and marketing of other commercial crops such as tobacco and green beans became available these crops came into production. The most recent change in agriculture has been the growth of the animal industry. This has resulted from an expanding southern market for beef and dairy products, and as an adjustment in land use in keeping with the capability of the steeply sloping land. Most cleared land here is best used as grassland.

The most recent commercial expansion has taken place in manufacturing. There are many handicaps to industry in this area, the chief of which is still inaccessibility. Industries locating here have been those which use local raw materials or require little in the way of raw materials to be brought in, and whose finished products are compact and costly enough to bear the high costs of distribution. A major attraction for industry is the abundant supply of intelligent, though unskilled, labor.

Recent years have also witnessed an increase in tourist facilities and an expansion of the tourist trade, capitalizing on the natural attractions through advertising and supplementing these with many man-made attractions.

Fully as remarkable as the transformation taking place in land use is the changing character of the mountain people. The barriers that so long prevented the cultural advancement of the mountaineer are crumbling before the forces of improved communications and educational facilities. As a result the Southern Appalachian island of early American culture is rapidly disappearing and a new mountain culture appears to be emerging, one reflecting the close communication of the region with the rest of the nation and adjusted to the limitations imposed by the physical environment.

234 pages. \$2.93. MicA 55-1399

THE RELATIONSHIP BETWEEN ROUGHNESS
OF TERRAIN AND PHENOMENA
RELATED TO AGRICULTURE
IN NORTHEASTERN UNITED STATES

(Publication No. 12,108)

John Clinton Hook, Ph.D.
State University of Iowa, 1955

Chairman: Dr. Walter F. Wood

The purpose of this study has been to investigate the degree to which the areal differentiation in roughness is associated with the areal differentiation in agricultural land use, agricultural land values, and the density of the rural farm population in northeastern United States.

The roughness of a country was determined by a roughness index, a measure based on the density of the contour lines in a county. A comparison of these roughness indices with two systems of landform classification for northeastern United States has shown that the roughness indices are in general agreement with the other systems, in that the indices are low in areas of plains and high in areas of mountains.

Throughout the study the association between variables has been measured by the coefficient of correlation (r), the coefficient of partial correlation and the coefficient of multiple correlation. In many cases the regression equation and the standard error of the estimate were also computed. All computations are based on a random sample of 100 of the 349 counties in the area under investigation.

It has been shown that farmland use is more intensive in the counties with low roughness indices. There is a decided tendency for the percentage of farmland in pasture to increase and the percentage of farmland in cropland to decrease as the roughness increases. The amount of money spent on the "specific farm expenditures" of the Census decreases as the roughness increases. The degree of mechanization,

as measured by the amount spent on petroleum products, decreases as the roughness increases. The value of the agricultural production and the value of the agricultural land buildings decrease as the roughness increases.

The coefficients of correlation between the roughness index and the above variables, however, while statistically significant, are not high. The closest association is between the roughness and the percentage of farmland in pasture ($r = +.73$). This study, however, has been primarily concerned with only one variable in the physical environment, roughness. There are undoubtedly numerous other physical, social and economic variables associated with differences in the agricultural phenomena being studied.

The association between some of the other physical and social variables and the agricultural phenomena has been only briefly investigated. It has been shown that land use intensity decreases as the distance from large metropolitan centers increases but that the roughness also increases as the distance from the metropolitan centers increases. In the investigation of the density of the rural farm population it was discovered that there is only a slight tendency for the rural farm population densities to decrease as the roughness increases but that the roughness was also inversely related to the level of living index. Variations in the density of the rural farm population were also associated with variations in the percentage of a county that was in farms, the length of the growing season and the distance from large metropolitan centers.

This study has also served to illustrate the value of multiple correlation in geographic analysis. It appears to be extremely unlikely that the areal differentiation of complex social and economic phenomena, such as the agricultural activities investigated in this study, can be explained, or accounted for, by the areal differentiation in only one other variable. As has been shown it is possible to introduce successively several variables into a geographic problem.

185 pages. \$2.31. MicA 55-1400

GEOLOGY

GEOLOGY AND MINERALIZATION OF THE NAICA
MINING DISTRICT, CHIHUAHUA, MEXICO

(Publication No. 12,051)

Allen Mordorf Bassett, Ph.D.
Columbia University, 1955

The Naica mining district is in south central Chihuahua, on the western edge of the central plateau of northern Mexico. Limestone replacement ores of lead, silver, and zinc, with minor copper, gold, and mercury, occur in nearly uniform limestones over 3,500 feet thick that are correlated with the Aurora formation of Albian age. Overlying these are the Del Rio shale (100 feet), Buda limestone (300 feet), both

of lower Cenomanian age, and a marl (as much as 750 feet) probably of basal Upper Cretaceous age. Tertiary pyroclastic rocks lie unconformably above this sequence.

The pre-Tertiary rocks are regionally folded into northwest-trending linear ranges and at Naica these, as well as the pyroclastic rocks, are domed, probably by an intrusive body. The dome is split by a fault of perhaps 3,500 feet displacement. The downdropped block is broken into a complex network of fractures. Aplite dikes, lime silicates, and metallic sulfides occur in these fractures but only beneath the shale, which appears to have acted as a barrier to upward-moving solutions. The silicates are thought to be of hydrothermal origin and are, in paragenetic order,

wollastonite, amphibole, zoisite, diopside-hedenbergite, and andradite. Amphibole and garnet are the most abundant. Sulfides formed after the silicates in three stages: arsenopyrite and pyrite (early); sphalerite, galena and chalcopryrite (middle, main ore stage); chalcopryrite, unidentified bismuth-silver minerals, and cinnabar (late).

Classification of the deposit as xenothermal in the earlier stages and epithermal in the later stages best fits the inferred conditions of formation.

66 pages. \$1.00. MicA 55-1401

STRUCTURAL GEOLOGY OF SOUTHEASTERN COAHUILA AND ADJACENT PARTS OF NUEVO LEÓN, MEXICO

(Publication No. 12,053)

Zoltan de Cserna, Ph.D.
Columbia University, 1955

The area discussed lies south of the cities of Saltillo, Coahuila and Monterrey, Nuevo León, comprising approximately four 30-minute quadrangles which are crossed in a northwest-southeast direction by the arcuate folded ranges of the Sierra Madre Oriental.

The rocks are predominantly marine sediments, ranging in age from Upper Jurassic to Upper Cretaceous and consisting of limestones, shales, gypsum, and phosphorite. Intrusive rocks are stocks of granodioritic composition, and the extrusives range from rhyolites to basalts.

The field study enabled the recognition of three structurally distinct belts of the Sierra Madre Oriental which are from northeast to southwest: the Valley and Ridge Belt, the Plain and Range Belt, and the Intrusive Belt. The sedimentary section thins from 4,500 meters in the Valley and Ridge Belt to 2,000 meters in the Intrusive Belt. Folding in all three belts is highly developed on a gypsum or siltstone base producing *décollement*. Low-angle thrusts are characteristic of the frontal portion of the Valley and Ridge Belt; fault-folds characterize the Plain and Range Belt. The Intrusive Belt is made up of folds which are modified by high-angle reverse faults and intruded by stocks.

The three-fold structural development in this part of the Sierra Madre Oriental is explained as a result of deformation which did not extend into the pre-Argovian rocks in the Valley and Ridge Belt which make up the basement, on the basis of stratigraphic evidence and calculation of depth of folding. The more complex structures, the presence of intrusives and extrusives in the Intrusive Belt, are correlated with greater depth of deformation due to their proximity to the main zone of orogeny. The bend of the Sierra Madre Oriental at Monterrey, Nuevo León, is considered to be the effect of basement control causing a salient.

The structural evolution of the region, as evidenced by stratigraphic data, indicates that the Sierra Madre Oriental is a structure resulting from late

Mesozoic- early Tertiary western North American orogeny which masks structures in the basement produced by Paleozoic eastern North American orogenies.

66 pages. \$1.00. MicA 55-1402

GLACIATION OF THE COEUR D'ALENE DISTRICT, IDAHO

(Publication No. 12,264)

Wakefield Dort, Jr., Ph.D.
Stanford University, 1955

The name Coeur d'Alene District is here applied to the drainage area of the South Fork of the Coeur d'Alene River. This district is located in the panhandle of northern Idaho. Evidence of the former existence of alpine glaciers on the mountains of the district consists of a glaciated topography of cirques and U-shaped valleys, glacial markings on the bedrock, and scattered deposits of glacial till along the upper reaches of certain valleys. The altitude of the snowline was approximately 5,300 feet on north-facing slopes. Snow which collected in valleyheads above this elevation nourished glaciers that flowed down the pre-existing stream valleys to points below the snowline. No ice formed on south-facing slopes. The position of the front of each glacier at the time of maximum advance was mapped chiefly on the basis of observed changes in valley cross-section—from the U-shape characteristic of glacial erosion to the V-shape formed by rapidly cutting streams. No terminal moraines have been recognized; if such had ever existed, they have been removed by erosion.

The longest glacier, extending approximately five miles from the source cirques, was in the valley of Canyon Creek. It descended to an elevation of 3,950 feet, and impounded small ponds in the tributary gulches. A shorter glacier moved down the precipitous slopes of Stevens Peak (6,844 feet above sea level) and terminated on the floor of Coeur d'Alene Valley at an elevation of about 3,400 feet. The freshness of the cirques, the small amount of weathering and erosion of glacial and glaciofluvial deposits, and the only slight filling or draining of cirque lakes indicate an age comparable to that of the Wisconsin stage of the Great Plains Pleistocene sequence.

During the glacial maximum, ice of this stage not only occupied the glaciated valleys, but also capped the higher divides. Evidence of this more widespread ice consists of exposures of striated bedrock on high surfaces above the limits of cirque development. That the ice caps and valley glaciers were coexistent is suggested by the freshness of the markings left by the ice caps.

An even earlier period of glaciation is suggested by the presence of glacially striated cobbles in coarse gravels several hundred feet above the drainage levels of the latest episode of glaciation. These gravels fill remnants of a previous valley system to depths of more than 750 feet. The length of time necessary to enable streams to fill these ancient valleys with glacial

outwash and to erode the present valleys to depths of as much as 800 feet through resistant quartzite strata, all prior to the latest episode of glaciation, suggests a pre-Wisconsin age for this earlier period of ice formation. Lack of advanced weathering of the high gravels favors an Illinoian rather than an older age.

There is no record of the advance of continental ice into the Coeur d'Alene District. Continental ice sheets did, however, obstruct the westward drainage some fifty miles west of the district. This ice dam resulted in the impounding of Glacial Lake Coeur d'Alene to a level of approximately 2,650 feet above sea level and the submergence of the lower reaches of the South Fork of the Coeur d'Alene River. Icebergs containing granitic boulders frozen into the ice many miles to the north were blown south and east on this lake, and many of the erratics were dropped in the Coeur d'Alene District as the bergs melted. The waning continental ice left a dam of outwash debris which still impounds a large lake. The present floor of the Coeur d'Alene Valley is graded to this lake level.

133 pages. \$1.66. MicA 55-1403

THE GEOLOGY OF A PART OF THE SOUTHERN WASATCH MOUNTAINS, UTAH

(Publication No. 12,179)

Raymond Earl Metter, Ph.D.
The Ohio State University, 1955

This report concerns the portion of the southern Wasatch Mountains and the northern Cedar Hills bounded by Spanish Fork Canyon, Utah Valley, Santaquin Canyon, Gardner Hollow, and Thistle Creek. Dry Mountain to the west and Loafer Mountain to the northeast are the prominent topographic features.

Sedimentary rocks range from pre-Cambrian (?) to Recent in age, and the oldest are to the west. A basal crystalline complex on Dry Mountain is overlain by quartzites and shales of possible pre-Cambrian age, which are unconformable beneath a Cambrian sequence similar to the rocks of the Tintic district. Cambrian formations are, from older to younger, the Tintic quartzite, Ophir formation, Teutonic limestone, Dagmar limestone, Herkimer limestone, Bluebird dolomite, Cole Canyon dolomite, and Opex dolomite. No rocks of Ordovician, Silurian, or Devonian age are recognized, but basal dolomites of rocks called Madison may be correlative with the Late Devonian Jefferson dolomite.

Mississippian rocks include the Madison limestone, Deseret limestone, Humbug formation, and Great Blue formation. All are mainly carbonate rocks, but the Humbug also contains sandstones and quartzites. The poorly exposed Manning Canyon shale may possibly have Pennsylvanian strata in its upper portions.

The Oquirrh formation is a very thick sequence of limestones, sandstones, and quartzites ranging in age from Springeran, or possibly Chesterian, to

Wolfcampian. Permian formations include the Kirkman limestone, Diamond Creek sandstone, and Park City formation. Only portions of the Triassic Thaynes and Ankareh formations are exposed. Jurassic units include the Nugget sandstone and the Twin Creek formation.

No definite Cretaceous beds are present, but the basal North Horn formation may be of this age, and it is unconformable over older strata. Overlying the North Horn are the Tertiary Flagstaff and Colton formations. A piedmont deposit, here called the Crab Creek formation, may be a lateral facies of the Tertiary units mentioned above. Pyroclastics of possible Oligocene age lie on a Tertiary surface of considerable relief.

Undifferentiated Tertiary fanglomerates, terrace gravels of Tertiary and Quaternary age, alluvial fans, undifferentiated alluvium, and small moraines on Loafer Mountain comprise the remainder of the mapped sedimentary deposits.

The basal complex, a diabase body in the Tintic quartzite, and one or more sills make up the crystalline rocks.

The southern Wasatch Range is the eastern limb of a former north-trending anticlinal structure that turned eastward in the vicinity of the northern portion of Loafer Mountain. Dry Mountain is essentially an east-dipping homocline, but Loafer Mountain includes a variety of structures. The Shurtz Canyon anticline and the Pole Canyon syncline are on the northeastern side, and the Loafer Canyon anticline is on the southwestern side, of Loafer Mountain. On the southeastern side of the mountain, beds strike north and dip steeply eastward. Strata in the northern Cedar Hills are gently warped.

At least three thrusting movements have occurred. The Santaquin overthrust, followed by the Dry Mountain thrust, evidently involved strip-thrusting from the west along the Ophir formation and the Manning Canyon shale respectively. Both are pre-North Horn in age. The Bear Canyon thrust is post-Flagstaff, and represents compression from the north.

Normal faults are of several ages. Most important is the Wasatch frontal fault, bounding Dry Mountain on the west and Loafer Mountain on the northwest and west. It has an en echelon pattern near Payson. The Thistle Canyon fault is the western side of a graben. Areas north of the crystalline complex on Dry Mountain and near Rock Canyon on Loafer Mountain are complexly faulted. Transverse tear and normal faulting accompanied the folding on both Loafer and Dry Mountains.

Small metal mining and sand and gravel operations are of only minor economic importance.

262 pages. \$3.28. MicA 55-1404

STRUCTURES AT THE NORTHERN END OF THE SANTA CATALINA MOUNTAINS, ARIZONA

(Publication No. 12,000)

Roberts Manning Wallace, Ph.D.
University of Arizona, 1955

The northern end of the Santa Catalina Mountains, Pinal County, Arizona, is made up of granites, sedimentary rocks, and intrusive bodies ranging in age from early Precambrian to Recent, that fit into a structural framework with four dominant trends: west-northwest, northwest, northeast, and nearly north-south. These trends, developed in the oldest Precambrian rocks, have influenced, directly or indirectly, the deposition and the deformation of all younger rocks. Metamorphism where present is of low to medium rank, even on the schist-granite contacts. Of the late Precambrian Apache group, the Pioneer shale, the Barnes conglomerate, and the Dripping Spring quartzite, in part, were derived from the surrounding earlier formations. Only a thin

remnant of the final Precambrian Mescal limestone survived the pre-Paleozoic erosion controlled by uplift on northwest trending structures.

The Paleozoic Era was a time of general slow sedimentation followed in early-Cretaceous (?) time by accumulation of coarse debris, possibly a local expression of the Nevadan Revolution. At this time the four trends in the structural pattern again became active, and subsequent erosion removed much of the Paleozoic rocks. The resulting debris, plus a large amount of volcanic material, collected in basins to form the Lower Cretaceous (?) conglomerates.

The structural framework was again active sometime in the Tertiary period, when a large dioritic mass was intruded and subsequently metamorphosed. Debris from the erosion of this uplift formed part of the Gila conglomerate and Rock Dump material. Ten-inch high scarplets, trending north-south along the western boundary of the Santa Catalinas, indicate that the mountain mass has recently sunk.

93 pages. \$1.16. Mic 55-136

HEALTH SCIENCES

HEALTH SCIENCES, PHARMACY

A COMPARATIVE EVALUATION OF PRESERVATIVES FOR USE IN EYE SOLUTIONS

(Publication No. 12,082)

William Mohn Heller, Ph.D.
University of Maryland, 1955

Supervisors: Drs. Noel E. Foss, Donald E. Shay and C. T. Ichniowski

The purpose of this investigation was to evaluate various chemical agents of possible use in attaining and maintaining the sterility of aqueous solutions to be used in the eye. The pharmaceutical characteristics of modern ophthalmic solutions have been reviewed, with emphasis on sterility and sterilization.

Thirteen chemicals were investigated to determine their ability to self-sterilize eye solutions. The method used was a slight modification of that of McPherson and Wood (93), the most stringent test yet proposed for this purpose. Briefly, it was determined whether 3.0 cc. of the preserved eye solution would kill all the contaminants which normally enter during the compounding of an eye solution with chemically clean, but not sterile, equipment; plus the contaminants which might enter through opening and closing of the container during use; plus one drop of a 24-hour culture in trypticase-dextrose broth of one of the following organisms: *Pseudomonas aeruginosa*, *Escherichia coli* or *Staphylococcus aureus*. This 3.0 cc. of highly contaminated eye solution was tested for viable organisms after two, five, ten, fifteen and thirty minutes.

The effects of pH, buffer chemicals, medicaments, autoclaving, and ageing were studied.

Irritation studies on rabbit eyes were carried out by the method of Draize, Woodard and Calvery (115) on solutions of the most promising preservatives in distilled water, in a phosphate buffer at pH 6.8, a boric acid buffer at pH 5.0, and in a methylcellulose vehicle.

Methyl and propylparaben combinations, oxyquinoline sulfate, thimerosal, Emcol E-607, hexachlorophene, dichlorophene and bithionol were eliminated after a preliminary study. It was noted that antibacterial effectiveness of hexachlorophene, dichlorophene, bithionol and chlorobutanol was decreased by polysorbate 80.

Aqueous solutions of the following chemicals were found consistently effective within ten minutes contact: benzalkonium chloride 1:10,000 and 1:5,000, benzethonium chloride 1:2,000, phenylmercuric nitrate 1:2,000 and benzyl alcohol, 3 per cent. Less effective but still bactericidal within 30 minutes contact were phenylethyl alcohol, 1.5 per cent, and chlorobutanol, 0.75 per cent.

Benzethonium chloride 1:2,000, phenylmercuric nitrate 1:2,000 and benzyl alcohol, 3 per cent, were moderately to markedly irritating to rabbit eyes.

Solutions of phenyl ethyl alcohol, 1.5 per cent, develop a flocculent precipitate after standing several weeks, but the precipitate apparently has no effect on the germicidal powers of the solution.

Chlorobutanol is less active in alkaline solutions and after autoclaving.

Where compatible, benzalkonium chloride 1:5,000 is the most effective, nonirritating, self-sterilizing agent for eye solutions. It is not effective in

fluorescein sodium solutions. Its effectiveness is lessened by methylcellulose, boric acid, zinc sulfate and by lowering the pH of the solution.

Where sterility is imperative, sterilization should

be carried out by heat or filtration and the preservative depended on only for maintenance of sterility.

107 pages. \$1.34. MicA 55-1405

HISTORY

HISTORY, GENERAL

VERBAL OPPOSITION TO INDUSTRIALISM
IN AMERICAN MAGAZINES, 1830-1860

(Publication No. 11,973)

Aurele Adelard Durocher, Ph.D.
University of Minnesota, 1955

Major Adviser: Leo Marx

By 1830 the Industrial Revolution was well under way in northern and eastern United States. General reaction was that of enthusiastic approval of industrialization. But a few Americans, remembering the anti-manufacturing bias of eighteenth-century agrarians, demurred. Reading in British publications and American reprints about industrial conditions in Europe, some persons condemned the inhuman nature of work in British factories, the misery of the factory population in England and France, the reprehensible practice of child labor there, the supplanting of aesthetic standards by industrial considerations, and the "greedy" manufacturers, who were said to be responsible for these factors. They advised fellow Americans not to imitate the industrial "feudalism" of Europe, which would cause American factory workers to become "depraved" and manufacturers to constitute a new "aristocracy" endangering a democratic United States. Bad industrial conditions in parts of New England, they asserted, proved their contention that industrialization was an unwelcome European importation.

Certain conservatives, including some clergymen, feared the new mechanical innovations. They pointed to pre-industrial contributions to culture, superior to machines and manufactures, ridiculed machines and their inventors, extolled household manufactures and the agrarian way of life, and decried the loosening of rural bonds and the ultimate disintegration of society resulting from the manufacturing system. Clergymen declared that a decline of church attendance, a lessening degree of religious zeal, and a materialistic spirit in laity and clergy were the results of the advancing industrial economy, cupidity of manufacturers, and public preference for irreligious standards.

Protests from many agrarians were even louder. Affirming the superiority of agrarianism over other ways of life, they claimed that manufacturers were a new American "aristocracy" taking labor and capital away from the farmers, causing contemporary social and economic ills, condoning practices "leading to

wars," and championing the protective tariff, symbol of the manufacturers' cupidity, selfishness, and thirst for political power.

Sympathizers with the industrial workers were as vocal. Magnifying evil industrial conditions, they pointed to the alleged enslavement of workers by machines, the long hours in factories, the "callous" use of women and children by manufacturers, the monotonous character of mechanical labor, and technological unemployment. They called attention to the breakdown of morals in factory communities, the regimentation in the typical factory, and the passing of the pre-industrial yeoman spirit. A new "aristocracy" of manufacturers was arising, they said; therefore, legal, political, and economic measures were necessary to curb their excessive power. The settling of the West and/or a complete social reconstruction were also useful means of "escaping machinery."

Many critics were concerned about established values. Deprecating the "present" and eulogizing the past, they claimed that such values had once been deeply appreciated, as evidenced in extant artistic monuments; they felt that their contemporaries valued only the mechanical, the material, the practically usable. Art, imagination, and spiritual values were therefore in eclipse. Witness, they said, the current aesthetic poverty in building, art, literature, and music, and confusion in politics and society. Unimaginative profit-seekers were appropriating nature for base ends, they declared; but an even greater folly was being perpetrated: "mechanicians" desired to supplant men's efforts and directing genius by machines, whose automatic operation was the ultimate in desirability. As a consequence of the Industrial Revolution, they asserted that utility, ugliness, mechanical ingenuity, matter, and mechanism were enhanced respectively above intrinsic value, beauty, imagination, spirituality, and the vital.

358 pages. \$4.48. MicA 55-1406

CHARLES McLEAN ANDREWS: A STUDY
IN AMERICAN HISTORIOGRAPHY

(Publication No. 12,054)

Abraham Seldin Eisenstadt, Ph.D.
Columbia University, 1955

Nowhere designed to be a formal biography, this study of the contribution of Andrews undertakes two things: to present and evaluate the system of

historiography of one of the greatest modern historians of colonial America, and to understand that system within the broader context of its times.

Trained in the 1880's under Herbert Adams at the Johns Hopkins University, Andrews was very much a member of the new "scientific" school of American historians. The ideal governing the school was that history was a science, a probing for exact and incontrovertible truth, an attempt to discover the actuality of the past, ultimately a quest for the tendencies underlying historical evolution. Under this ideal, the historian was a man of science, a skilled and precise worker, rigorously trained in the seminar, capable of using primary materials fully and critically, transmitting his findings to the scholastic world through articles and monographs. That he could expertly practice the ideal of his craft, Andrews revealed well enough in the most important study of his earlier years, *The Old English Manor* (1892), in which he not only surveyed the Anglo-Saxon manor before the Norman Conquest but also undertook to solve the problem of its institutional origins.

It was, however, to the field of American colonial history that Andrews most fully applied his system of historiography. With others, he argued the need for an imperial viewpoint toward the early American past. The latter could be properly understood only if the historian took up his point of observation in England, only if he saw the colonies as integral parts of a great colonial empire, only if he extended his view to include all thirty colonies of this empire and not merely the famous thirteen, and only if he studied the English side of the Anglo-American community rather than the American side alone. Andrews' contribution, as he summarized it, was that he put the "colonial" back into American colonial history. This he did above all, in his two major works: *The Colonial Period of American History* (4 volumes, 1934-38) and the monumental *Guides to the British archives for materials dealing with American colonial history* (3 volumes, 1908-1914).

That his *Colonial Period* did not appear until the 1950's, when Andrews was past seventy, made it perhaps inevitable that his system of historiography should be all the more exposed to the critique of changing ideas in American historiography. His system was questioned both as to its principles and its contents. As for the latter, critics noted that Andrews had largely confined himself to the political and administrative sides of his subject, that he had been deficient on economic history and more so on social history, that he had put the "colonial" back into American colonial history only to remove not a little of the "American." As for the principles of his historiography, the "scientific" ideal under which Andrews had worked was seen to have its limitations: the ultimate truth of the past could not be ascertained, as Andrews hoped it might, and the past which each generation saw was a different one, befitting the new generation's own needs and circumstances. Indeed, Andrews' system had itself derived from the conditions of his times: from the philosophic and scientific currents in Western society in the late nineteenth century and from the growing Anglo-American friendship of the early twentieth century.

Andrews brought to consummate expression both the "scientific" ideal of American historiography and the imperial viewpoint of American colonial history. Whatever may be the limitations of either the ideal or the viewpoint, they are those of the age and the school in which Andrews belonged rather than of the historian himself. 396 pages. \$4.95. Mic 55-137

HISTORY, ARCHAEOLOGY

VIOLATIO SEPULCRI: AN EPIGRAPHICAL STUDY

(Publication No. 10,876)

Rev. John Sylvester Creaghan, S. J., Ph.D.
Princeton University, 1951

The purpose of this dissertation is to give a complete account of *violatio sepulcri*, throughout the Graeco-Roman world of antiquity. More than 3500 epitaphs, which contain additional clauses forbidding this crime by threatening various remedies, have been studied according to ordinary epigraphical methods. Additional evidence reveals that the practice of writing such adscripts on the tombstone originated in the ancient East during the second millennium B. C. This custom was widely adopted in Asia Minor and it spread to Rome during the first six centuries of our era. After legislation was introduced to prevent this delict, the custom of writing such adscripts on epitaphs was gradually discontinued. The most recent law forbidding violation of the grave was promulgated in the *Codex Iuris Canonici* and the tombstone of William Shakespeare is a more modern epigraphical example.

The various prohibitions are discussed in the first chapter. Burial of others and similar actions are most often forbidden in Asia Minor, while alienation of the grave is usually prevented in the Roman documents. Exhumation is mentioned only rarely. Although expressed negatively, these clauses reveal a positive and wide-spread belief that the tomb is an exclusive place where the departed members of a family, who have shared life, are to lie together in their last resting place unmolested by strangers. Many dire curses are threatened against violators and these are examined in the two following chapters. Pagan imprecations are treated first and it is pointed out how the early Christians, who believed in the resurrection of the body, readily adopted this custom, using curses peculiar to their own faith. It is clear that violation of the grave was first regarded as an offense against the gods, a sin. Subsequently fines were threatened and other civil measures were taken to prevent violation, which gradually came to be looked upon as an offense against the state, a crime. Mulcts and other legal aspects are discussed in the fourth chapter.

The final chapter is historical and interpretative. It begins with a brief account of *violatio sepulcri* in the ancient Orient and concludes with a more thorough

examination of all non-epigraphical references to this crime. The literary evidence is first presented and the legal documents which have descended to us in the *Corpus Iuris Civilis* are arranged chronologically and interpreted according to conclusions already drawn. In this discussion arguments are given to demonstrate that a famous inscription from Nazareth, now in the Cabinet des Medailles at Paris, is not an imperial edict of Augustus Caesar (as most jurists and epigraphers hold), but more probably a rescript of Septimius Severus.

The thesis begins with a short introduction in which a few examples of the type of epitaph studied here are given and the central problem is stated. A few more general conclusions are summarized at the end. Since each chapter has a certain continuity of its own, all epigraphical discussions of a purely technical nature are included in the notes and Appendix III. More than 60 new readings and restorations are suggested and one epitaph is published here for the first time. A few long tables are arranged in Appendix II, and a complete bibliography of all the inscriptions included in this study is listed in Appendix I. Three plates are added for illustration.

Thus, a rather complete study and interpretation of *violatio sepulcri* according to several *fentes historiae*, which complement one another in a remarkable way, is presented here. Archaeologists, historians and jurists will, doubtless, discover additional evidence, but such new findings should be interpreted in the light of this dissertation, which contains the essential account of violation of the grave according to our present knowledge of antiquity.

389 pages. \$4.86. MicA 55-1407

HISTORY, MEDIEVAL

A BOOK ON THE MERITS OF JERUSALEM BY
THE SHAYKH THE IMAM JAMĀL-AL-DĪN
ABU-AL-FARAJ 'ABD-AL-RAHMAN IBN-'ALI
IBN-MUHAMMAD IBN-AL-JAWZI, MAY GOD
HAVE MERCY UPON HIM

(Publication No. 10,927)

Jibrail S. Jabbur, Ph.D.
Princeton University, 1947

This dissertation is a critical edition in Arabic and a translation into English of a manuscript entitled *The Merits of Jerusalem* by Abd-al-Rahmān abu-al-Faraj ibn-al-Jawzi 508-597 A. H. (1114/5-1201 A. D.). It is a unique manuscript (probably from the XIV century) preserved in the Garrett collection of Princeton University. The translation includes historical, geographical and philological notes.

In this manuscript the author discusses the merits of Jerusalem and its importance to the Moslem world as follows:

Jerusalem is the most sacred town in the Holy

Land. The mountain on which Jerusalem stands is one of the holy mountains by which God swore. Solomon built the Sanctuary of Jerusalem on an ancient foundation. David was first ordered by God to build it, but was deprived of this privilege because of his sins. About twelve thousand workers were engaged in the construction. Even the jinn took part. The Sanctuary was paved and decorated with gold and silver which God made grow on two trees near one of its gates.

Solomon was the first to pray in it. He asked for wisdom to rule and was granted it. Many miracles took place therein. A chain was hung from heaven to earth which only one who is not guilty could reach. The Prophet made his nocturnal journey to the Sanctuary which was blessed, because it was the abode of prophets and the place to which angels descend. A great reward is promised to him who prays in it. The good deeds and the bad deeds are doubled when committed in it, and only the voice of its muezzin is heard by the people of heaven.

There is great merit in dwelling in Jerusalem, for the city is God's Paradise on earth and its Sanctuary is one of three mosques worthy of visiting.

Many prophets died in the Holy Land. Whosoever visits the place should pray in the *mihrāb* of David and swim in the spring of Siloam.

The children of Israel were punished by God because of their corruption. They killed some of their prophets and God sent Sinḥārīb, Bukhtnassar and other kings to punish them and carry them off to captivity. Jerusalem was destroyed but was later rebuilt. The Romans did not take good care of the Sanctuary when they occupied the Holy Land.

God commanded Moses and his people to proceed to the Holy Land, but the honor of its occupation was reserved to Joshua and the new generation of the Israelites.

The Sanctuary was the *qiblah* of all the prophets. Muḥammad himself prayed toward it for sixteen or seventeen months, but he wished God had turned his face to Makkah, the *qiblah* of his forefathers. The story of the nocturnal journey is related as was heard from the Prophet. The Prophet was made to stop at the tombs of Abraham and Jesus and pray. The *mi rāj* on which he ascended to heaven was of gold and silver stairs.

In the year fifteen Umar ibn-al-Khaṭṭab commanded Amr ibn-al-Āṣ to fight the Romans in Palestine. Amr defeated the Roman commander in Ajnādayn and called the caliph to attend the capitulation of Jerusalem.

The Franks occupied Jerusalem in 492 A. H.. They killed more than seventy thousand moslems and looted the Sanctuary. An appeal was sent to Baghdād for raising recruits to help the oppressed Syrians but was of no avail. About a century later Salāḥ-al-Dīn captured Jerusalem and dispatched the news to Baghdād.

Many distinguished people visited Jerusalem and lived in it. Some of the companions of the Prophet were buried there. Angels and ascetics frequented the Sanctuary and prayed therein.

Jerusalem shall be the place of assembly on the

Day of Judgment. Isrāfil shall blow his trumpet from the Rock of the Sanctuary and all the people of the world shall assemble there for Reckoning.
95 pages. \$1.19. MicA 55-1408

**THE POPULATION OF FRANCE IN 1328:
AN EXPLORATION INTO
HISTORICAL DEMOGRAPHY**

(Publication No. 11,938)

John Thomas Krause, Ph.D.
New York University, 1954

Adviser: Wallace K. Ferguson

Almost every investigator has found that the French population in 1328 was as numerous as that of the eighteenth century. If true, the existence of such a dense medieval population raises numerous questions concerning traditional explanations of European history. However, considerable criticism has been levelled at the existing estimates on three grounds: the similar conclusions have been based on contradictory assumptions; second, such estimates imply the existence of a more prosperous medieval agriculture than some investigators have been willing to grant; and third, these estimates implicitly contradict seemingly well-established demographic generalizations. In an attempt to solve these problems, this work is divided into three parts: the size of the population, the amount of subsistence-wealth, and the analysis of demographic conditions.

The basic data for the estimation of the size of the French population in 1328 are hearth counts: one which covered most of the kingdom, and numerous regional surveys. Previous discussion has been concentrated mainly on the national survey, but a detailed analysis shows that no precise estimate can be based on this document. At best, it indicates a population of between 23.4 and 33 millions. Analysis of the regional data, which are more precise, shows that the population probably numbered between 28 and 30 million. That the growth between 1200 and 1328 was moderate is indicated by other regional evidence.

In order to ascertain the general level of French agricultural production about 1328, statistical and quasi-statistical materials were used. Evidence on the amount of land under cultivation, the degree of agricultural knowledge, and the amount of agricultural capital indicates a level of productivity which was superior to that of the eighteenth century. Existing knowledge of crop-yields, well-being of the peasantry, and wage-data confirm this conclusion.

That such a high level of productivity is plausible on general grounds is indicated by an analysis of the factors of economic growth. The limited destructive capabilities of medieval armies, the low rate of taxation (compared to that of the eighteenth century), the absence of a costly and inefficient bureaucracy, and a favorable geographical environment combined to assure a high level of production and a relatively egalitarian system of distribution. It seems clear that

medieval France could have supported a population of between 28 and 30 million people.

Consideration of the demographic variables confirms the belief that the population was quite large in 1328. Factors of mortality, such as the food-supply, types of disease, and standards of hygiene, were such that the mortality was probably about twenty-five per thousand, a rate which would permit the attainment of a high density of population. That a density comparable to that of modern India did not result is to be explained by the fact that the medieval French, like the eighteenth century Swedes and French, limited the birth rate by various customs.

Hence, the analysis of three types of evidence, hearth counts, economic materials, and demographic data, show a high degree of consistency. The hearth counts indicate that there were between 28 and 30 million Frenchmen in 1328. The economic materials show that such a number were probably maintained at a relatively prosperous level. Demographic materials show that such a large population could have existed and help to explain the maintenance of a high level of living.
285 pages. \$3.56. MicA 55-1409

**INTELLECTUAL FREEDOM AND ITS
LIMITATIONS IN THE UNIVERSITY OF
PARIS IN THE THIRTEENTH AND
FOURTEENTH CENTURIES**

(Publication No. 10,271)

Mary Martin McLaughlin, Ph.D.
Columbia University, 1954

Abstract not available.

438 pages. \$5.48. Mic 55-138

HISTORY, MODERN

**PATTERNS FROM THE SOD: LAND USE AND
TENURE IN THE GRAND PRAIRIE, 1850-1900**

(Publication No. 11,895)

Margaret Beattie Bogue, Ph.D.
Cornell University, 1955

This study describes and analyzes major changes in land use and tenure in eight east central Illinois counties, Champaign, Ford, Iroquois, Kankakee, Livingston, McLean, Piatt, and Vermilion, lying in the cash grain farming area of the state.

Relying heavily upon county archives, newspapers, agricultural journals, manuscript business records and personal papers, local biographical materials, and government documents as sources of information, the study essays first to trace the development of the original pattern of landownership, local criticisms thereof, and to evaluate its significance in the area's tenure history. Next two conspicuous groups of

landowners whose holdings originated in the frontier period, the cattlemen and the large landlords, receive attention. A consideration of the influence that periods of depression and prosperity, land values, population pressures, technical innovations, and land use problems like fencing and wet land drainage had upon tenure between 1850 and 1900 follows. Farm tenancy both as an economic phenomenon and as an institution receives considerable description and analysis. The study concludes with treatment of two problems which vitally affected all the area's farmers and landowners, agricultural credit and taxation.

From this study a number of conclusions may be drawn. Some of the major ones follow. Political, economic, and geographic considerations combined to produce a pattern of original landownership including thousands of small holdings and a number of holdings of 1,000 to 54,000 acres. Although owners of the latter were branded "speculators" and blamed for the area's slow development, local critics over-emphasized the significance of such holdings, most of which were short lived.

The cattlemen and the large landlords who acquired large acreages in the frontier period played a less ephemeral role in the ownership picture, developing extensive and intensive farming businesses, most of which weathered economic changes and remained partially intact in 1900.

Two key problems of land use, fencing and the drainage of wet lands, greatly retarded intensive farming until the late 1870's. The expense of fencing never sharply cut by herd laws as many had hoped was considerably reduced with the advent of barbed wire, a very satisfactory substitute for wood and stone. Drainage legislation, which permitted the organization of tax supported districts, and tile eventually brought reclamation of wet soils within the means of small holders.

The depressions of the 1850's and 1870's, the difficulties inherent in developing prairie farms, and the rise in land values contributed to the growth of many small farms in the 1860's and 1870's. The progress of mechanization, generally low levels of produce prices, credit facilities, and the existence of an agricultural frontier encouraged growth in average farm size in the 1880's and 1890's.

Throughout the nineteenth century tenancy was a quantitatively significant tenure arrangement for it offered non-farmer heirs and investors in land, retired farmers, and holders of foreclosed property an important source of income. It offered new settlers an opportunity to learn the region before buying land; farmers of small means a way of working toward landownership; and sons of retired farmers practical experience.

Agricultural credit facilities, 1870-1900, made the intensive development of the area's agricultural lands possible, encouraged the growth of larger farms, the investment of non-farmers in farm land, and gave vitality to the agricultural ladder.

Real estate and personal property taxes, a fruitful source of complaint, encouraged intensive land use, contributed to the dissolution of large original landholdings, worked to the detriment of inefficient,

small farm operators, but apparently did not overburden efficient operators tilling farms of economic size.

While the area's farm products in 1850 and 1900 were virtually the same, methods of farming and the intensity of land use changed radically.

547 pages. \$6.84. Mic 55-139

TITAN OF THE ANDES: THE LIFE OF DOMINGO FAUSTINO SARMIENTO

(Publication No. 10,861)

Allison Williams Bunkley, Ph.D.
Princeton University, 1948

Domingo Faustino Sarmiento (1811-1888) was born in San Juan and educated in that primitive pioneer environment. Reading whatever he could find, and particularly influenced by writers of the Enlightenment, he conceived an ideal picture of how the world should be: well ordered, rational, progressive.

The world in which he lived, however, contrasted radically with this. Chaos reigned in the 1820's in his nation. Petty tyrants and political bosses vied for power in bloody civil wars. Drawn into this conflict, the side that he joined was defeated in 1831 and he was forced into exile in Chile. There his self-education continued. He worked in the mines of Copiapo, but even far beneath the earth's surface, he continued his reading.

Allowed to return to San Juan after a serious illness, Sarmiento founded a school and a newspaper, and these forced him to formulate positive ideas. In 1840, his continued political opposition again cost him his exile in Chile.

It was here that he began to conceive his positive philosophy. This must be understood in terms of his cultural heritage and environment. His was the tradition of the Hispanic World, the world that depended upon the personality as the common denominator of political life, that produced great personalities, but that never produced a political system, a science, or an industry. The Europe of the eighteenth and nineteenth centuries, built upon the values of reason, science, and materialism, judged the Hispanic World as decadent. The Spaniard's inability to fit into the World-Civilization caused him to be critical of his own culture and gave him a strong desire to reform it. The changes that occurred in the world at the beginning of the nineteenth century created a split between what was becoming a real irrational world and the ideal rational of the Cartesian Enlightenment society. This stimulated two intellectual solutions typical of this age: (1) reform the world to fit the rational pattern (2) deny the pattern and turn to relativism based upon the values of the individual's will and emotions. Both solutions appear in Sarmiento's thought. He consciously sought to reform his world to fit his ideal picture, attempting to reform the national intellect through education, the economy through liberal reforms, the racial composition through immigration, and even the language through rationalized orthography. This is Sarmiento's intent.

In his art, however, we find a different solution. The style of *El Facunde* betrays the Romantic features of the second solution, a reliance upon the relativistic values of the will and the emotions.

To understand the formation of his more purely political ideas we must seek the background of the dissolution of the Spanish Empire. The American colonies suddenly found themselves with no ties to the mother country. These Spanish Americas had then several alternatives of national organization. They could return to another monarchy as Portuguese America did. Or they could depend upon a dictator as the unifying factor, as most of Hispanic America did. Or they could create a constitution and a system of laws and rights and use these as the unifying factor as Anglo-Saxon America did. The first two solutions were different forms of personalism. The third might be called nomocracy. In Argentina, all of these solutions were tried. For the young student, Sarmiento, Nomocracy was the solution closest to the ideal that he had conceived, and his political ideas evolved from a foreign idea of democracy to a more properly Argentine idea of nomocracy.

Within this framework of thought he matured intellectually in Chile. During a trip through Europe, Africa, and North America he confirmed in his own mind many of his theories. And participating in the defeat of Rosas in 1852 and in part in the efforts to unify his nation under the new Constitution of 1853, he saw his nation remain divided until the Battle of Pavon in 1860.

After the unification, Sarmiento advanced rapidly towards positions of power that would enable him to put his ideas into action. As Governor of San Juan, Argentine Minister to the United States, and finally President, he faced many obstacles, both natural and human, but he tried to apply the many reforms that he had conceived to order the life of his nation: education, immigration, economic reform, etc. He left the presidency, however, depressed at his accomplishments. He had expected a change of almost magic rapidity after his reforms, and this of course did not come. In later life, as Senator, Minister of Interior and private citizen, he saw increasing evidence of the new personalism. He was repudiated by the Argentine people until he was finally defeated for the Chamber of Deputies in 1886. He saw controlled elections and officialism grow, blaming it on the Spanish "race" and the existence of democracy without nomocracy. In 1888, he died in Asuncion, Paraguay.

891 pages. \$11.14. MicA 55-1410

THE LIVERPOOL & MANCHESTER RAILWAY PROJECT, 1821-1831

(Publication No. 11,580)

Robert Eugene Carlson, Ph.D.
University of Pittsburgh, 1955

The opening of the Liverpool & Manchester Railway on September 15, 1830 was a major milestone in the progress of the railway from a relatively

inefficient form of land transport to a revolutionary system powered by steam. Even while it was being constructed, the Liverpool & Manchester Railway was viewed by many engineers and promoters as "the Grand British Experimental Railway," the success of whose venture would have decisive influence in shaping plans for the lines of railway yet to be built. When the experiment turned out successfully, the opening of the Liverpool & Manchester Railway proved to be the opening of the age of the steam railway.

Although several histories of the L & M have been written (for instance, by Henry Booth and, more recently, by C. F. Dendy Marshall and George S. Veitch), each either omits or treats inadequately certain important events or presents a rather one-sided story. To arrive at a better-balanced account, contemporary newspapers such as *The Times* of London, the *Liverpool Mercury*, and the *Manchester Guardian*, have been used extensively as have such periodicals as *Mechanics' Magazine*, *Mining Journal*, *Gentleman's Magazine*, *Annual Register*, and *Engineer*. In addition, a complete analysis has been made of the Minutes of Evidence and Report of the 1825 House of Commons Committee on the L & M Bill and the 1826 House of Lords Committee on the L & M Bill; these gave information unavailable elsewhere without which any account of the formation of the Liverpool & Manchester Railway would be incomplete. For the Parliamentary story, the *Journals* of the Houses of Commons and Lords have been thoroughly exploited; for the powers and responsibilities of the Company, the L & M Railway's enabling Act of 1826 and four amending Acts have been carefully examined. These sources were supplemented by the Minutes of the L & M Railway Company, its Board of Directors, and its Finance Committee, as well as the semiannual and annual reports of the Company. Finally biographical information about such leading figures as Joseph Sandars, Henry Booth, George Stephenson, William James, and Charles Vignoles, as well as many other men responsible for promoting, constructing, and operating the railway between 1821 and 1831, was used.

The Liverpool & Manchester Railway Project evolved out of England's Industrial Revolution, Lancashire's growing population, commerce, and industry, and the inability and unwillingness of the existing waterways (the Duke of Bridgewater's Canal, the Mersey & Irwell Navigation, and the Leeds & Liverpool Canal) and turnpikes to provide facilities that would adequately meet the increased demand. In this situation, in 1821 Liverpool merchants, supported by their own as well as Manchester and London money, set out to build a 30-mile double line railway between Lancashire's two leading cities; specifically the railway was to supplement, not to supplant, the existing transportation system. After first failing to get an enabling Act in 1825, primarily because of errors in their plans and surveys as well as the deep-seated opposition of the landed classes and the waterways, the L & M Railway Company was chartered on May 5, 1826. Under the exacting direction of George Stephenson, an almost level and relatively straight line was built; the construction was highlighted by the digging of a 2,200-yard tunnel under the city of Liverpool, the

making of extensive excavations and embankments, and the floating of the line across Chat Moss. In October, 1829, in order to decide the power to be used, extensive trials of competing locomotives were held at Rainhill; the outcome of these trials was the adoption of the steam locomotive in place of stationary steam engines or horses. The line was opened on September 15, 1830.

In its first year of operation the Liverpool & Manchester Railway proved conclusively that passengers and all types of freight could be hauled safely and profitably at speeds of from 12 to 30 miles an hour. Within a few years, England and the Western world followed suit; the steam railway, thus introduced, remained the prime form of overland transport for almost a century. 385 pages. \$4.81. MicA 55-1411

THE POLITICS OF PROTEST IN MINNESOTA, 1890-1901, FROM POPULISM TO PROGRESSIVISM

(Publication No. 11,968)

Carl Henry Chrislock, Ph.D.
University of Minnesota, 1955

The concern of this study is with two of the protest movements of the 1890s. The first was essentially agrarian. Its principal support came from wheat farmers, its appeal to other groups was limited, and its chief instrument was the Populist party. The second movement, state-wide in scope, was part of a regional protest against the trend toward monopoly in the nation's economic development.

Both movements were rooted in the economic and social maladjustments produced by a generation of rapid growth. Of particular importance was the plight of the Minnesota wheat farmer. Another problem was that of defining the economic relationship of Minnesota to the older centers of finance and industry. Added to this were clashes of interest between city and country, the tensions created by the variety of ethnic backgrounds in Minnesota's population, and the problems growing out of rapid urban development.

The first four chapters analyze this background. The remaining nine chapters reconstruct chronologically the history of political protest in Minnesota from 1890 to 1901. The rise and fall of Populism as an organized movement lies at the center of this story.

The defeat suffered by the Republican party in 1890 reflected both agrarian and regional discontent. The Populist party emerged in the aftermath of this election. It aspired to become the spokesman for state-wide protest, but this aspiration was not realized. The election returns for 1892, 1894, and 1896 demonstrated that Populism was a majority force only in the wheat counties.

There were several reasons for Populism's failure to make a wider appeal. Among these were the fears created by the Pullman strike of 1894, the records of Populist state governments in Colorado and

Kansas (as these records were generally interpreted), the irresponsibility of some third-party leaders, and Republican campaign polemics.

Both Populism and free silver met their demise after 1896. This helped foster a new climate in which Mark Hanna's "sound money" coalition lost that part of its cohesiveness which depended on fear of Populist "radicalism." In this new climate, apprehensions about monopoly were strengthened. The accelerated trend toward business consolidation during the closing years of the century reinforced these apprehensions. The popularity of Governor Van Sant's crusade against J. J. Hill's Northern Securities Company is a measure of the strength commanded by the anti-monopoly forces in 1901.

Thus, one of this study's major conclusions is that reaction against Populism's alleged "radicalism" may have delayed the maturation of a state-wide protest movement. Many who feared and distrusted big business were impelled to support so-called Republican "conservatism" because they feared third-party "extremism" even more.

Another conclusion is that both protest movements were committed to the preservation of a competitive, small-entrepreneur economy and the values with such an economy was identified. In other words, there was little sympathy for the "regulated collectivism" espoused by one wing of the Progressive movement in the twentieth century.

Newspapers and manuscript collections owned by the Minnesota Historical Society were the major sources for the study. The newspapers used were of three types: the Twin City dailies; country newspapers; and reform papers such as Ignatius Donnelly's *Representative* and W. R. Dobbyn's *Progressive Age*. The most helpful manuscript collections were: The Ignatius Donnelly Papers, The Knute Nelson Papers, The John Lind Papers, and The James A. Tawney Papers. 367 pages. \$4.59. MicA 55-1412

THE REVOLUTIONARY THEORIES OF LOUIS-AUGUSTE BLANQUI

(Publication No. 12,071)

Alan Barrie Spitzer, Ph.D.
Columbia University, 1955

Blanqui's role in the history of socialism was to combine theoretical communism with revolutionary voluntarism. Few realize that his activism was based upon elaborate, though often inconsistent, theories of reality, human nature and social history.

His philosophic assumptions were those of eighteenth-century materialism qualified by a justification of political voluntarism in a deterministic universe. The basis for this was his theory of the reciprocal interaction of brain and environment. An improved society could condition the brain and in turn be conditioned by it.

Blanqui's philosophy of social change was not materialistic but idealist. Like the philosophes he

defined progress as the spread of enlightenment. The function of revolution was to free the peoples' minds from the chains forged by their exploiters. The suppression of religion was the prerequisite for that intellectual liberation which must precede rational reform.

Furthermore, the existence of capitalist economic institutions enabled the unscrupulous permanently to exploit the ignorant. Without an imposed Equality, Liberty and Fraternity were unobtainable. The bases of capitalism were under-consumption and usury; the typical capitalists, misers and moneylenders.

This naive economic theory is one cause of assertions that Blanqui was not a socialist but a petit-bourgeois political revolutionary. However his writings and speeches evince a commitment to collectivism and a tendency to identify political conflict with class struggle. He recognized that class power was closely related to control of the instruments of production but, unlike the Marxists, defined as proletarians all those who did not support themselves by the labor of others.

Blanqui believed that only a revolution would allow the masses to apprehend their plight. Before the revolution one could not plan future institutions the ideas for which could only be liberated by the revolution. He rejected Utopian socialism to stand in the French tradition of Hébert, Babeuf and the advocates of violent reform. He adhered to this tradition long after most radicals had abandoned it, insisting on a moral obligation continuously to battle oppression.

While Blanqui advocated techniques such as strikes and clandestine propaganda as well as conspiracy and insurrection, all his tactics were directed toward the day when historical conditions would permit a coup de force. He planned his insurrections on

the assumption that these conditions were almost always present in contemporary France. Paradoxically, he was usually pessimistic about the immediate chances for his conspiracies after they had been organized, but his manifest role as a devoted revolutionary and his impatient following usually forced him into action.

Perhaps he was continuously committed to reluctant insurrectionism because of his ideas of social change and the history of revolutions. Enlightenment, the prerequisite of progress, was so stifled by reactionary institutions that only a minority was sufficiently enlightened to begin a social revolution. The tactics of this essentially Parisian elite were suggested by the history of previous revolutions which, begun by spontaneous popular action, were absorbed by bourgeois opportunists. The genuine revolutionaries had to forestall this usurpation by just anticipating the spontaneous mass rising.

This committed Blanqui to impossible attempts to seize power at precisely the right moment rather than to the defense of daily proletarian needs or the preparation of a mass organization for long-run political endeavor.

Although Blanqui plotted to overthrow capitalism, he assigned the immediate tasks of a post-revolutionary dictatorship to education and anti-clericalism. The control of political power would eventually guarantee a people sufficiently enlightened to abolish economic injustice.

Blanquism was a very French embodiment of the transition from libertarian rationalism to an ideology of class struggle and from the period of bourgeois political revolutions to the movements of an industrial proletariat.

216 pages. \$2.70. Mic 55-140

HOME ECONOMICS

A STUDY OF THE EXPENDITURES OF NINE FAMILIES OVER A PERIOD OF YEARS

(Publication No. 9793)

Ruth Elinor Deacon, Ph.D.
Cornell University, 1954

The records of nine families covering a total of 149 years were analyzed in order to study their financial adjustments. The incomes of five of the families were predominantly from salaried sources. The incomes of two of the salaried families were also influenced by farm and other additional sources. Four families were dependent on incomes from farm operations. The farm and salaried income families were compared in each of the methods used for the study of adjustments.

Principles were developed for classifying expenditures into ten individual categories for purposes of analysis and for consistent comparisons from one

family to another. The principles and resulting classifications were effective for the purposes. The individual categories analyzed were: food; clothing; housing; operation; furnishings and equipment; transportation; health and personal; education and recreation; gifts and contributions; savings and life insurance. The shelter category was a combination of housing, operation, furnishings and equipment, and fire insurance.

The methods used were effective in the study of financial adjustments over a period of years. Each method made its own contribution to the total picture but would have been inadequate alone. Dollar comparisons were useful in studying the stability of expenditures over the years, in evaluating dependency units, and in determining criteria for an adequate dependency unit. Relating the direction of annual changes in income and expenditures was useful in indicating the categories responding to income changes and in influencing expenditure changes.

Ratios were useful in determining the importance of each category and of total expenditures relative to income. Interviews were useful for supplementing and interpreting information in the records.

The length of the record period, changes in the number of dependents, the location of the family or income source, automobile ownership and home ownership were factors other than price changes and the amount of income that were related to the amount of expenditure fluctuations. Relative to income, farm families had more fluctuations in the furnishings and equipment, health and personal, and operation categories.

Dependency comparisons resulted in the conclusion that the per capita unit is just as satisfactory as the per ammain unit which was developed to take differences in sex and age into account. An adequate unit, according to personal clothing comparisons, should also account for the position of the dependent in the family. Per capita food expenditures for the farm families were about half those of salaried families.

The study of the effect of the direction of annual changes in income indicated that furnishings and equipment was the responsive individual category to large income decreases and increases. Education and recreation was the category least likely to decrease with income declines. Food responded readily to income increases but resisted income decreases. Health and personal expenditures were least likely to decrease when total expenditures decreased, and transportation and shelter had the greatest influence on expenditure increases.

From the study of ratios of expenditures to income, food was found to be the only individual category for which expenditures were usually more than ten per cent of income. Farm families had lower incomes and spent relatively more than the salaried families for food even though the dollar outlays for food were lower. Expenditures for the combination of categories in the shelter classification also totaled more than ten per cent of income. Food, shelter, operation, and health and personal expenditures appeared to be negatively related to the amount of income.

Further use of these methods with a larger group of family records is needed to verify the tentative conclusions suggested by their use. More comparisons from one economic period to another are also desirable. 251 pages. \$3.14. MicA 55-1413

THE ROLE OF THE HOME ECONOMICS
TEACHER IN THE EDUCATION OF
SLOW-LEARNING GIRLS IN OHIO
PUBLIC SECONDARY SCHOOLS WITH
IMPLICATIONS FOR TEACHER EDUCATION

(Publication No. 12,039)

Helmi Louise Koivisto, Ph.D.
The Ohio State University, 1954

Adviser: Dorothy D. Scott

The program of the modern school is based upon the democratic concept that there must be respect for individual differences. The present study was an effort to help clarify the role of the home economics teacher in the education of slow-learning girls.

The study was designed to test the hypothesis that needs for teacher education in home economics would become apparent as analyses were made of: (1) beliefs and problems of home economics teachers in instructing slow-learning girls in Ohio public secondary schools; (2) practices and methods in instructing such students; and (3) the preparation of home economics teachers for teaching slow learners. For the purposes of the study, the slow learner was defined as an individual between 50 and 90 I.Q. who is unable to reach the achievement level of average students because of intellectual limitations.

Data were obtained from a questionnaire survey of a sampling of high school home economics teachers in Ohio and from observations and interviews in a selected group of home economics programs for slow-learning girls. The total returns were 377 out of 757 inquiries submitted, a response of 49.8 per cent. Eight school systems and a total of 23 schools were visited, and 52 teachers were interviewed.

The practical, functional nature of home economics was believed to be its primary contribution to the education of slow-learning girls. Because of the early marriages of such students, a special urgency for instruction in home economics was expressed.

Ninety-one per cent of the 377 respondents taught slow learners in regular home economics classes. Three fourths stated that they were meeting needs of slow learners fairly well; however, over one-half reported concern with ten out of thirteen problem areas in teaching these students. Over three-fourths indicated difficulty with reading disabilities, trying to meet individual differences in large classes, and suitable techniques for teaching slow learners. Nutrition, time and energy management, and money management were considered the most difficult curriculum areas to teach to such students.

No unique procedures in teaching slow learners were reported in the inquiry, and very few were discovered in the selected programs. As a whole, the selected programs had not developed sufficiently toward the concept that the student should be prepared for the many aspects of family living.

As sources of help to teachers instructors slow learners college preparation and in-service education seemed to be of limited effectiveness to instructing slow learners.

Major recommendations for teacher education in home economics include the following:

1. Full recognition should be given to the personal and family life needs of youth.
2. Requirements for prospective teachers should include more learning experiences in the areas of home management, family relationships, and child development.
3. The problem of reading disabilities needs serious consideration in teacher education programs at both pre-service and in-service levels.
4. More attention should be given to helping teachers develop effective teaching procedures and resources for meeting individual differences in large classes.
5. Prospective teachers should face typical school situations which include a cross section of the student population.

6. If possible, some work in special education should be required of prospective teachers so that they can obtain a better understanding of the characteristics and needs of exceptional children.
7. Greater utilization should be made of the easily available sources of in-service education in seeking solutions to problems in teaching exceptional students.

Conclusion

Slow learners need not be problems if they are accepted and understood. It should be a challenge to home economics teachers, and one of their obligations, to assist such students to achieve acceptable homes and wholesome family life. However, instruction must be brought to their level of understanding. The evidence gathered in this study supports the need for teacher education to assume greater responsibility in helping home economics teachers fulfill their role in meeting individual differences in the classroom.

288 pages. \$3.60. MicA 55-1414

JOURNALISM

ATTITUDES OF NEWSPAPERMEN OF UNITED STATES DAILIES TOWARD PUBLIC RELATIONS IN MUNICIPAL GOVERNMENT

(Publication No. 12,107)

Milton Clifford Hollstein, Ph.D.
State University of Iowa, 1955

Chairman: Professor Leslie G. Moeller

An unmistakable trend is growing toward establishment of public relations offices in municipal governments in the United States. The trend is predated by the growth of federal and state information activities since 1900.

Proponents of municipal public relations chiefly are government administrators and the ever-growing number of practitioners of government public relations themselves, who insist they offer a means to get news to the public and to make government more understandable. Critics contend government "information" activities tend to restrict the flow of news except that which immediately benefits incumbents.

This study determined whether newspapermen who cover and direct coverage of municipal government see in municipal public relations a valuable adjunct or a threat to their newsgathering work and to "the people's right to know."

The method was a mail survey of city editors and reporters of all newspapers in cities over 50,000 population, of city editors and reporters of a sample of newspapers in cities of 25-49,999 population, and of city editors only (who usually were reporters as well) in cities of 10-24,999 population.

Responses came from 297 city editors and 263 reporters, or 60 percent of those included in the survey. The questionnaire was built on two types of questions, the "free response" and the four and five-point rating scale.

Responses of city editors were compared with those of reporters to determine whether reporters, being closer to the actual operations of city government, would make significantly different responses than the city editors. The responses, however, did not differ materially.

The study showed:

Virtually all newspapers are deeply interested in reporting on local government. Respondents overwhelmingly reported their relationships with city government were cordial, regardless of whether a public relations office had been established in city government or not.

In cities over 500,000 population respondents predominantly saw their roles in reporting local government as being "watchdog." In other cities newspapermen predominantly believed they should be as complete and impartial as possible. Two thirds of all the respondents said they were meeting their own standards for informing about city government.

Among the respondents who listed some limitations, city editors blamed chiefly inadequate staff, even in the largest cities. Reporters chiefly blamed limited access to news and personal characteristics of city officials.

Few of the respondents, however, felt that a public relations office would help solve these problems or remove barriers. On no one question did the response that could be termed "favorable" toward municipal

public relations outweigh the "unfavorable." Respondents working for evening newspapers were more inclined than others to favor the strong, central public relations office; respondents in city manager cities were less favorably inclined toward the central office than were other respondents.

By far the greatest objections raised toward municipal public relations were that such offices would propagandize, suppress news and make access to officials more difficult for newspapermen.

If such offices were to be established, the public relations officer should be a former newspaperman, an aide to an administrator (rather than a relatively independent functionary) and should give all sides of all questions that arise, a requirement, most respondents felt, that was unattainable.

The findings lead to the conclusion that while newspapermen will work with public relations offices in city government, as they would with any legally developed government agency, existing public relations offices must demonstrate and proclaim their good works before the municipal public relations movement will find wholehearted acceptance from the majority of the working press.

378 pages. \$4.73. MicA 55-1415

OBJECTIVITY AND RESPONSIBILITY IN NEWSPAPER REPORTING

(Publication No. 12,064)

Ken Macrorie, Ph.D.
Columbia University, 1955

Both teachers of college English and communication and the practicing newspaperman seem to be evolving a new concept of objectivity in news reporting. They assert that the subject of a news story must be placed in its context of time and environment for the reader and that the old ideal of absolute objectivity – meaning complete detachment, disinterest, and camera-like recording of an event – is impossible of human attainment.

This evolution of a new concept of objectivity is occurring within a larger background, or stream, some of whose currents are (1) the growing realization among many human inquirers that all acts of perception, including news reporting, consist of transactions between the observer (including his past experience and present anticipations), the observed

and the immediate situation; (2) the general dissatisfaction of inquirers in many fields with the diffuseness of the term objective, which has at least seventeen current meanings; (3) the failure of propaganda analysis to serve as a useful context for examining news reporting processes; (4) the gradual emergence in the twentieth century among professional inquirers (for example, scientists, historians, sociologists, physicians, as well as newsmen) of an enlarged meaning of objectivity which touches at many points the concept of responsibility; and (5) a new emphasis on responsibility as signifying response – to materials, to persons, and to the inquirer himself, a working attitude that any inquiry or report cannot be isolated in some "scientific" way from human values and responsible choices.

This study traces generally these streams of thought, emphasizing how findings of students of perception illuminate the process of the newsman, who is taken as any newspaper staff member who influences a news report. It presents the English and communication teacher, not with a content analysis of news reports showing the bias of a newspaper, but with a picture of the newsman in his working world as he shows his responsibility through selections in space, time, words and pictures; in the respect he demonstrates for the individuality and dignity of the human beings he writes about and for; in the way he answers the pressures of his own conscience and the demands of persons who would have him manipulate the news in their interest. It suggests that evaluators of news reporting need to know the choices open to the newsman at all stages in his process. It indicates the range and complexity of these choices in detailed discussions of published news stories and in two extensive case histories of actual news stories in the making, at the Ridgewood (New Jersey) Sunday News and The New York Times.

The study concludes with suggestions for further exploration of an approach already begun by newsmen and by outside evaluators such as English and communication teachers – for example, discarding the superficial formula story of sex-sensation and violence and making every report a human-interest story in the sense that it treats persons and events as unique and humanly significant, speaks tentatively at appropriate times rather than with authoritative finality that closes off all reflection, and provokes thoughtful and continuing responses from readers. Through a humanly possible objective method, a newsman reports news responsibly.

279 pages. \$3.49. Mic 55-141

LANGUAGE AND LITERATURE

LANGUAGE AND LITERATURE, GENERAL

HISPANISM IN ITALY: AN APPRAISAL OF THE CONTRIBUTION OF BENEDETTO CROCE TO THE EVALUATION OF SPANISH LITERATURE

(Publication No. 12,258)

Raymond Liberty Biondi, Ph.D.
Stanford University, 1955

This study is an attempt to trace the influence of Croce's doctrines on Italian scholarship, and the effect that the new criticism had upon Hispanism in Italy. Since Italian attitudes toward Spanish literature are intimately bound up with the vicissitudes of Italian literary theories, aesthetics and criticism, the study has been preceded by a brief review of Spanish culture in Italy, particularly during the nineteenth century.

Italian interest in Spanish culture, never very intense, had virtually ceased after the middle of the nineteenth century, and it was not until the last decade of the century, largely through the work of Benedetto Croce and Arturo Farinelli, that Italian literary criticism and historiography began to do justice to the Iberian peninsula. Farinelli, however, was closely identified with the leaders of the historical method at Turin. While he was one of the prime movers in the revival of Spanish studies in Italy, at the same time, he promoted a type of research that was responsible for Croce's reaction leading to the latter's first works on literary criticism and aesthetics and the eventual founding of his periodical La Critica.

The rift that had begun to develop in the Italian world of learning with the publication of Croce's first theoretical essays reached, with the founding of La Critica, the proportions of an open break, which can be regarded as a reassertion, in a new guise, of a fundamental intellectual antithesis that has divided Northern and Southern Italy for several hundred years – a sort of Turin-Naples axis in this case, the antithetical poles of which were represented respectively by the Giornale storico della letteratura italiana and La Critica. Along this imaginary axis, hesitating between the two extremes – historical method and aesthetic method – and exhibiting, as a consequence, varying degrees of schizophrenia, were those whose faith in the historical method had been undermined, but who lacked either the philosophical training or the temperament (and sometimes both) demanded by Crocean criticism. The effects of this kind of frustration can be easily seen in the works of Farinelli.

As a result of Croce's veritable pontifical supremacy over Italian criticism and scholarship, there

was a self-conscious effort on the part of scholars and critics to avoid transgressing against the new criticism and a tendency to be apologetic about erudition that smacked too much of the positivist period. By his having marked out the proper functions of literary criticism, the aimless, exaggerated pursuit of inconsequential minutiae in Italian Hispanism was kept to a minimum.

Croce's influence on Italian Hispanism must be weighed also in the light of the example of his own critical observations on Spanish culture. Inasmuch as Croce set the example for the new methodology by his own researches, and since many of his Spanish studies are not sufficiently well known among American Hispanists, an account of the great amount of work accomplished by him in this field has been included in this study. It is precisely in Croce's Spanish studies that we can observe the transition from the old methodology to the new.

Croce's critical evaluation of Spanish literature, although seemingly severe, is not overly so when considered in the light of the distinction that he is careful to draw between poetry and literature.

214 pages. \$2.68. MicA 55-1416

THE FICTION OF HENRY MACKENZIE

(Publication No. 12,261)

Byron Ralph Bryant, Ph.D.
Stanford University, 1955

The novels of Henry Mackenzie (1745-1831), popular Edinburgh lawyer and miscellaneous writer, have not previously been given thorough and intensive study, particularly in regard to their breadth of subject matter and technique, plus the evidences of literary experimentation and development which can be discovered when the novels are carefully analyzed in chronological order. Mackenzie's one full-length biographer, Harold William Thompson, considered him principally as a representative of "the golden age of Burns and Scott." Other writers consider him solely as a sentimentalist and base most of their statements on Mackenzie's first novel only, or they describe him as a mere imitator of Sterne.

The present dissertation shows that each of Mackenzie's novels – The Man of Feeling (1771), The Man of the World (1773), and Julia de Roubigné (1777) – differs significantly from the others in style, plot structure, manner of characterization, and attitude toward sentimentalism versus realism. It is argued that Mackenzie shows a progressive development as a literary craftsman, in opposition to those who consider The Man of Feeling his only interesting and significant book. The variations among the novels in

both subject matter and technique are cited as evidence that Mackenzie was a far more self-conscious literary experimenter than has previously been granted.

The Man of Feeling is found to be less chaotic than has been generally supposed. Its twenty-four chapters are unified by a concern with one character, Harley, a personification of sentiment, whose experiences and relations with others provide a panorama of sentimentalism. Its complete idealization of sex and passivity of character are shown to reflect a purpose markedly different from that of Sterne.

The Man of the World is shown to be a remarkable experiment in complexity of plot, in which a two-part structure with elaborate parallelisms between the two parts is used as the framework for the story of three generations of a simple family who suffer at the hands of a sexually-aggressive aristocrat. It reflects a growing clarity in the author's mind regarding the limitations of sentimentalism, particularly as reflected in a hero whose eventual triumph is attained through prolonged penitential suffering, and an additional element of realism is provided by the fact that the hero shares his success with a commonplace and comparatively colorless person who has done less to merit his good fortune.

A simpler plot, coupled with a concentrated unity lacking in The Man of Feeling, is used in Mackenzie's experiment in the epistolary novel, Julia de Roubigné. Using plot elements suggested by La Nouvelle Héloïse and Othello, Mackenzie creates an effect different from that of either. He now focusses upon a few characters, each of whom has an intense inner life, and creates a unified effect distinct from his sources partly through his conception of tragedy as brought about by particular excesses of the basically good qualities of his characters. Sentiment, which had become increasingly a surface manifestation in his second novel, is now critically viewed as dangerous unless regulated by propriety and practicality. In this way, he offers an implied rebuke to the sexual mores of Rousseau, as he had earlier criticised by implication those of Sterne. In this way Mackenzie's third novel is seen as an appropriate climax of his experiments in variety of plot and technique, as well as of his movement toward a clarification of the role of sentiment in relation to ordinary life.

Two appendices are offered: A, on Sentimentalism in the eighteenth century as a background for allegations in the main text; B, on Mackenzie's short stories, to complete the general consideration of his narrative powers. 297 pages. \$3.71. MicA 55-1417

THE INTELLECTUAL BACKGROUND OF FULKE GREVILLE

(Publication No. 12,262)

Burnham Carter, Jr., Ph.D.
Stanford University, 1955

During his seventy-four years Fulke Greville served in the government of three monarchs: Elizabeth, James I, and Charles I. Though he himself was never a figure of great public moment, he was always in a position to know anyone who was. As an acute and sober-minded observer of the intellectual cross-currents of his day, he wrote down, for his own satisfaction, the sum of his experience and philosophy in his lyrics, verse treatises, and plays.

At the heart of every study of Greville must be a careful examination of his religion, specifically, the extent of his Calvinism. In his career and choice of friends he was never more of a Puritan than Sir Philip Sidney, for example. In his writings, on the other hand, he never loses a profound sense of his own and mankind's depravity. On such points as election and predestination he is annoyingly vague; doctrinal precision is not his forte. At the same time, a pragmatic determination to get on with the world's work runs through all his thinking. He thus takes his place besides those who favored the moderated, more manageable Calvinism of the Elizabethan compromise.

The first half of the Treatie of Humane Learning argues that a full awareness of the effects of the Fall should lead one to expect little from mankind save depravity and failure. He further emphasizes mankind's incapacities by pointing out, after the fashion of the academic skeptics, how our empirical examination of human mental faculties leads to a similar pessimism. In varying degrees his discouragement echoes that of Cusa, Agrippa, Montaigne, Raleigh, and the Seneca of the Epistles. Yet Greville is closest of all to Francis Bacon. The second half of the Treatie argues for a limited confidence in new attempts to investigate human knowledge but never shares Bacon's enthusiasm for his "new organon."

Greville's low opinion of mankind reappears in his discussion of government. Although in theory he is a confirmed, even reactionary monarchist, his Poems of Monarchy contain much sensible, practical advice for kings weak and strong. His concern for good order in the realm is so great, however, that he can countenance no change in the status quo, no new political concept. His ideas on government are thus neither unjust nor irrational but simply obsolescent.

Although his gloom deepened after the death first of Sidney and then of Elizabeth, Greville never despaired, either of his own soul or of the need to make the most of one's limited capabilities. His work mirrors the difficulties which a man accustomed to Elizabethan ways of thought had to face in the Jacobean era. Greville himself was too conservative to shift his ideas of God, of human learning, and of government. Nevertheless, he remains a fine example of a disillusioned but tough-minded Renaissance thinker

determined to accept human fallibility for what it is and yet to do his best within those narrow limits. 280 pages. \$3.50. MicA 55-1418

**A TALE OF WONDER: A SOURCE STUDY
OF THE WIFE OF BATH'S TALE**

(Publication No. 12,055)

Sigmund Eisner, Ph.D.
Columbia University, 1955

Chaucer's Wife of Bath's Tale is an Arthurian story in which a loathly hag barter vital information for an offer of marriage. After the crone has won her husband she becomes, before his amazed eyes, a beautiful young girl.

Not only have analogues of this tale appeared in medieval English versions but also in older Irish forms. The connection between the tales that originated in early Irish mythology and those belonging to the group of stories told about King Arthur has always been obscure. It has long been recognized that there was some relationship between the Irish and English versions, and scholars have suggested that the English tales had their source in Ireland.

What is probably the true relationship was suggested by a current theory of the transmission of Irish tales of mythology into the stories of Arthur. According to this theory, the results of intensive studies by Professor Roger Sherman Loomis and others, the Irish tales were fused, in Wales, with Arthurian stories and were retold in Brittany. Since the Bretons of the twelfth century were bilingual and often performed as conteurs before the various royal and lesser courts of France, the simplest explanation is that the Bretons retold the heroic Arthurian tales which had belonged to their people. The ruling classes of France and England at that time sharing a common language, the tales soon spread to England where the hero Arthur was gladly welcomed to his native soil. This theory, which had been advanced for most of the Arthurian tales, had never been tested in connection with the Arthurian Wife of Bath's Tale.

My first task was to amass those ancient Irish tales concerning the loathly hag who had become beautiful. Such stories, once collected, presented evidence that the function of the Irish loathly lady was threefold: Originally she was the earth goddess who married the solar deity. Ugly before this union, she became beautiful as the land itself becomes beautiful when, warmed by the approaching sun, it changes from winter to summer. Later the story became a political allegory in which the earth goddess became an abstraction known as the Sovereignty of Ireland and the solar deity was replaced by a given historic or pseudo-historic king. Finally, this bride of kings became an ideal who would in time relieve Ireland from her centuries of political and physical distress.

No tales of a loathly lady survive in the literature of Wales, but there is a medieval European story of a serpent which, on being kissed, became a beautiful

lady. This tale suggests a connection with the loathly lady tale and reveals an unmistakable Welsh influence. Secondly, a group of loathly lady stories appeared in the French Arthurian tales of Perceval. Finally, when we come to the English analogues of The Wife of Bath's Tale, we see that among these tales are passages revealing both Welsh and French influences.

Because none of the analogues discussed in this study show evidence of being direct ancestors of The Wife of Bath's Tale, it is impossible to present irrefutable proof that Chaucer's version of the loathly lady tale came to him through the channels discussed above. The collected evidence presented in this study does demonstrate, however, the strongest probability that The Wife of Bath's Tale did not differ from other Arthurian tales but came to Chaucer from Ireland through Wales, Brittany, and France.

203 pages. \$2.54. Mic 55-142

**THREE STUDIES IN
CHARLES ROBERT MATURIN**

(Publication No. 12,106)

Henry William Hinck, Ph.D.
State University of Iowa, 1954

Chairman: Professor Rhodes Dunlap

The three papers which compose the dissertation center in the figure of Charles Robert Maturin (1782-1824), great-uncle of Oscar Wilde. The first paper treats Maturin's influence upon Nathaniel Hawthorne, who is known to have read the play Bertram (1816) and the novel Melmoth the Wanderer (1820). Such influence, specifically in the case of Hawthorne's first novel, Fanshawe, and summarily in the case of his other novels, is denied. Fanshawe is shown to be modeled structurally upon Walter Scott's Rokeby, with the addition of Miltonic imagery and derivation of characters from Scott, Henry Mackenzie, and a then-famous classical scholar, William Melmoth the Younger. Maturin influence is, however, accepted for "Rappaccini's Daughter" and "Ethan Brand". In the case of "Ethan Brand", the influence is traced through the literary history of demonic laughter and the ideological resemblance between Ethan Brand and Melmoth the Wanderer.

The second paper discusses Maturin's tragedy, Bertram, in its historical aspect. A brief history of the play is given, including its preparation for the stage, the actors involved, its publication and various editions, and its eventual transformation into Bellini's opera, Il pirata. There is a brief survey of the contemporary drama, and, after this, a treatment of the sources and influences which operated on the play, namely, Hannah More's Percy, "Monk" Lewis' Adelgitha, Scott's Rokeby, and Harriet Smith's "Kruitznier". Any influence of Schiller's Die Räuber is denied. The play is also shown as foreshadowing Maturin's novel, Melmoth the Wanderer. The study posits the play as ranking only below Manfred in Gothic drama, but as

third-rate or below in general English drama. The conclusion is that Bertram owed its success to the Zeitgeist and the acting of Edmund Kean, who played the title role.

The third paper deals critically with the play. The verdicts of various critics, coeval to present-day, are reviewed, with especial attention to the criticisms of Coleridge and Goethe. Coleridge's critique is shown as largely irresponsible and picayunish, and that of Goethe as superficially assuming a non-existent Byronism. This is followed by a discussion of the structure, characters, atmosphere, "metaphysical" elements and style. The character of Bertram is ascribed to the Bertram of Scott's Rokeby, and the influence of Schiller and Byron is rejected. The tragedy is asserted to be a Romantic "she-tragedy," and a counterpoint of climatic and emotional tensions is indicated as the basis of its ability to create suspense. The influence of Joanna Baillie's theory of the passions is shown, and the possibility of similar influence from the Abbe' Provost. In conclusion, Maturin's essential position as novelist rather than dramatist is insisted upon.

197 pages. \$2.46. MicA 55-1419

EDWIN LAWRENCE GODKIN IN
The Nation: A STUDY IN POLITICAL,
ECONOMIC, AND SOCIAL MORALITY

(Publication No. 11,945)

James Gregory Murray, Ph.D.
New York University, 1954

Research Adviser: Oscar Cargill

The most significant work of Edwin Lawrence Godkin is to be found in the some two thousand editorials (called "leaders") which he wrote for The Nation (New York) from 1865 to 1902. A study of this material reveals that Godkin, not at all an original thinker, was an articulate spokesman for his generation and class. Underlying his work were the principles of "sweetness," that is, general moral goodness, and "light," or common-sense reasonableness. Not expecting to find these qualities in the people of a democracy, Godkin looked for and sought to cultivate them in an aristocracy of talent, which group would supply proper leadership.

The Nation was founded to promulgate Godkin's version of sweetness and light, to provide a forum for the aristocracy of talent, to correct the ills of yellow journalism, and to instruct the people in matters political and economic. Thus the magazine could be said to have a high moral purpose. This purpose is analyzed especially in relation to the following subjects: the theory of government, the mechanics of practical politics, the art of thinking about economics, a code for leadership, and a statement of the rights and duties of the people in a democracy.

Since Godkin was best known as a reformer, a chapter is included which deals with his crusades in behalf of municipal purity, civil service, and world

peace, that is to say, what the principled citizen ought to work for if there is to be morality and practicality on the local, national, and international levels.

Finally, Godkin's way of thinking and his reputation are viewed against the background of late Nineteenth Century currents of thought. His liberalism and conservatism, particularly as these are related to politics, economics, and social theory, are evaluated historically, and the reasons for his eclipse as a prominent figure in American journalism are suggested.

229 pages. \$2.86. MicA 55-1420

EMERSON'S CONCEPT OF GOOD AND EVIL

(Publication No. 11,602)

Brother F. Joseph Paulits, F.S.C., Ph.D.
University of Pittsburgh, 1955

This study examines the passages in Emerson's writings treating of good and evil and brings them into a synthesis comprised of three sections: Emerson's philosophy in general, serving as a most necessary foundation for the specific concept of good and evil; the concept itself; and ramifications of the concept in other areas of Emerson's philosophy.

Emerson's concept of good and evil is a direct and necessary consequence of his concept of the Over-Soul and its activities. The Over-Soul is at the center of Emerson's philosophy because all that really is is the Over-Soul. The Over-Soul, in itself, is absolute good, but it does not restrict its goodness to itself. It is in a constant activity called emanation, and all it emanates is good also, but only relatively so. The emanations may be on a strictly spiritual level as when the Over-Soul sends inspirations and revelations through man's Reason or causes virtue to flood his will; or the emanations may terminate in a material substance. The substance has existence and goodness only in so far as it is a manifestation or symbol of the Over-Soul. Matter, therefore, cannot be evil, for it does have at least phenomenal existence, and existence of any type in Emerson's philosophy ensures radical goodness. Goodness, then, is a name given absolutely to the Over-Soul and relatively to emanations of the Over-Soul. And, since the manifestations are in flux, their relative goodness will vary as the Over-Soul's presence in them increases or lessens.

Just as good is the name given to the Over-Soul and its presence in its manifestations, so evil is the name given to the absence or departure of the Over-Soul. Evil, therefore, has no existence that can be properly predicated of itself; in its essence (if the term can be used at all) evil is the interruption of the emanations of the Over-Soul and thus always must reside in some good. The interruption can occur, of course, only in the area of the emanations, because the Over-Soul itself is not subject to limitation of any type. The Over-Soul manifests itself in two principal ways - directly (or spiritually) by influxes into man's various spiritual faculties; and mediately (or materially) by terminating its activity in a material

phenomenon. Both kinds of manifestation are subject to specific evils. The first or direct emanation is subject to moral evil when a man ignores or disobeys the Over-Soul's influxes because of a too-great preoccupation with his own particular ego, a preoccupation prompted by desire for phenomenal goods without reference to their symbolic significance. Because of his spiritual myopia and consequent disobedience, he interrupts or limits the development of his universal ego, the ego which is his direct participation in the Over-Soul. The second or mediate manifestation is subject to physical evil when the forward movement of the Over-Soul advances beyond prior manifestations to new and better manifestations. The clash that results among the phenomena is called physical evil. Thus, physical evil can exist only on the phenomenal level and is constantly being subsumed into a higher good. Finally, there can be no absolute evil because that would assume a reality completely separated from the Over-Soul, an ontological and psychological impossibility in Emerson's emanationist philosophy.

We conclude that the only concept of more importance than good and evil in Emerson's philosophy is that of the Over-Soul itself, and that the two concepts are bound in a quasi-indissoluble relationship.

338 pages. \$4.23. MicA 55-1421

ANDREW MARVELL: MEMBER FROM HULL;
A STUDY IN THE ECCLESIASTICAL AND
POLITICAL THOUGHT OF THE RESTORATION

(Publication No. 12,068)

Dean Morgan Schmitter, Ph.D.
Columbia University, 1955

Andrew Marvell's poetry is widely and deservedly popular; his prose work, however, is little known, even though he had for two hundred years a high reputation as spokesman on affairs of church and state. Nowadays Marvell fanciers are a little surprised to learn that he was for twenty years a Member of Parliament, a whig before there were Whigs, and in the critical 1670s one of the prime prose writers for the causes of religious toleration and constitutional monarchy.

Only two modern studies - M. Legouis' critical biography and Miss Caroline Robbins' unpublished dissertation - have seriously considered Marvell's extra-political activities. This study limits its subject matter to the prose of Marvell, examining his religious writings against the background of Independence and high Anglicanism, and his political work as a part of the shifting intricacies of Court and Country Party manipulations.

Aroused initially by the harsh tone of Samuel Parker, later Bishop of Oxford, as he wrangled with the Independent John Owen, Marvell first entered pamphlet controversy with the rollicking *Rehearsal Transpros'd* (1672). Flushed by victory, Marvell was stung into writing another installment by a series of high Anglican rebuttals. In *Rehearsal Transpros'd: The Second Part*, over a year later, he sharpened the

burlesque good humor and slashed back at Parker, probably because of suppressed fury at charges of sexual irregularity between Marvell and Milton, cast by Richard Leigh, whom Marvell believed to be allied with Parker.

Marvell's union with the nonconformists was political, not theological. Convinced that the extra-scriptural elements of the Anglican communion were really a civil trespass upon the spiritual qualifications for salvation, Marvell argued with discursive wit for a limited protestant toleration. Under entirely different circumstances he argued the same proposition in *Mr. Smirke, or the Divine in Mode* (1676) and its appendage "A Short Historical Essay." Yet Marvell drew back from the subtle spiritual qualifications for salvation voiced by the rigorous nonconformist theologians. Still relying on the literal word of Scripture, he attempted in his last pamphlet, *Remarks upon a Late Disingenuous Discourse* (1678), to free the notion of divine foreknowledge from that of divine predestination in all human actions.

As he had attempted to bring the authoritarian church into harmony with individual consciences, Marvell attempted also to bring the last vestiges of the royal prerogative into harmony with the will of Parliament. In *The Growth of Popery and Arbitrary Government* (1677) he tried desperately to undermine the popularity that Danby had won for his Royalist-Anglican alliance in marrying the Catholic Duke of York's daughter to the protestant Prince William of Orange. Marvell wove together from scattered incidents a coherent account of an abstract plot fomented by abstract "conspirators." Working for parliamentary supremacy rather than the downfall of the Stuart line, he distorted events and personalities in order to cause the fall of Danby and the dissolution of Parliament. His involved purpose and obscure references become clear and purposeful when they are related to the complicated interplay of issues that existed in December, 1677.

Marvell did not have the inclination to develop his practical solutions into a system that transcended the religious plight of prominent protestant dissenters. Nor was he a political philosopher; he was trying only to meet the problems posed by Charles' government and the succession of the Duke of York. Practical rather than profound, he still contributed effectively to the long and bitter controversy that forced the evolution of religious and political problems.

291 pages. \$3.64. Mic 55-143

A STUDY OF THE METHODS, AIMS, AND
EXTENT OF REVISION IN FOUR WORKS
OF CURRENT NON-FICTION

(Publication No. 12,147)

Herman Rudolph Struck, Ed.D.
Michigan State University, 1953

This study of revisions was undertaken with the hope that it would provide fresh techniques for use in college composition classes, suggestions for

experimentation in teaching, and new information on writing problems in general.

The project divided itself into three parts. First, it was necessary to analyze the revisions in the work drafts of current writers to determine what qualities of writing required revision, to what extent they required it, what methods the writers used to achieve those qualities, and how extensively the writers used the methods identified. Second, it was necessary to evaluate present methods and text-book recommendations in the light of the information the analysis supplied. Third, it was necessary to determine, through this appraisal, the value of the study in terms of the instructor, the student, and methods of teaching.

The material studied consisted of four original drafts showing the writers' revisions. Drafts of the following works were employed: Russel B. Nye, *Midwestern Progressive Politics* (East Lansing [Mich.], 1951); Douglas S. Freeman, *Lee's Lieutenants, II* (New York, 1943); Ely J. Kahn, Jr., "Profiles," *The New Yorker*, XXIX (March 14, 1953), 36-58; MacKinlay Kantor, "Dear Old Ghost of Mine," *Esquire*, XXIV (Nov., 1945), 40-44, 171-174. The material included the complete draft of Kantor's article, and sections of the remaining writers' work. Before revision the drafts contained about thirty thousand words, and about two thousand separate revisions, these ranging from single-word revisions to revisions of entire paragraphs.

The changes made in the four drafts examined were analyzed in terms of their effects upon the writing, being classified under either "grammar and punctuation," "repetition," "meaning," "coherence," "emphasis," "concision," "tone," or "unclassified." Following classification, the total number of revisions comprising a single group were noted; these were then studied to identify, if possible, the techniques used to achieve the specific quality being investigated. Then, in separate chapters, the patterns or lack of patterns in each writer's revisions were illustrated and discussed. Finally, identical categories among the writers were compared.

The study revealed that the writers revised extensively. In a second draft of originally 13,000 words, Nye made approximately 850 revisions; Freeman, in a first draft of 6,700 words, about 240; Kahn, in a first draft of 6,000 words, about 430; Kantor, in a 4,600-word draft whose stage was unknown, also about 430 changes. The study also disclosed that as a group the writers revised chiefly to improve exactness of meaning, coherence, and emphasis; revisions of meaning far outnumbered other types, proving that transmitting precise meaning constituted the writers' major problem. Numerous methods were identified. Although most of these were methods recommended in current text books, a few were not; moreover, the study revealed the specific value of particular methods.

After examining textbooks on rhetoric, the present writer concluded, on the basis of the extensive revision made in the drafts studied and the complexity of the methods employed, that revision was not sufficiently emphasized in current texts, and that they should be either rewritten with a more clear-cut

recognition of the importance of revision than they now have, or supplemented with a volume devoted exclusively to revision.

Analysis of the findings in the study indicated that the writers' drafts could provide composition students with concrete proof of the necessity for revision; that the traditional method of assigning frequent short themes should be replaced by the assigning of one or two long papers, around which the term's work would focus; that some of the material in the drafts could be utilized to teach methods of achieving key qualities of writing more efficiently and effectively than they are now taught. 521 pages. \$6.51. MicA 55-1422

THE TREATMENT OF HUMBLE LIFE IN THE POETRY OF GEORGE CRABBE AND WILLIAM WORDSWORTH

(Publication No. 12,137)

Norman Field Winn, Ph.D.
University of Washington, 1955

Students of early eighteenth century literature will observe little correspondence, real or imagined, between actual conditions in humble life and their treatment in English poetry. While the poor rustic struggled with poverty and misery, writers characteristically fostered the myth that in an ideal environment he was virtuous, contented, and happy. Since common man had no social status, he was seldom considered worthy of detailed literary portraiture. He served rather as an incidental and decorative figure in philosophical or descriptive verse. During the course of the century, literary and philosophical developments resulted not only in mounting concern for the poor, but in honest poetic efforts to interpret their lives. Emerging at the same time were two opposing, but not always mutually exclusive, views of humble life. One, chiefly rational, iconoclastic, and factually realistic, was perpetuated by George Crabbe. The other, also basically realistic, but softened by idealism and sentiment, achieved salience in the poetry of William Wordsworth.

Both poets modified the traditions they had inherited. Crabbe's mature work, initially a reaction to pastoral artificiality, rejected many of the standards of formalism and eventually concentrated upon psychological interpretation of men in the middle and lower social orders. Much of Wordsworth's best poetry was at once a protest against conventional diction and an attempt to dignify the rustic in his association with nature. In the concept of organic growth in thought, feeling, and language, the poet advanced far beyond his precursors.

Neither poet was on a basis of fraternal equality with humble man; both were essentially observers whose sympathy with the poor is frequently overrated. Employing the most naked language, Crabbe described exactly what he saw. He allowed no illusions either to himself or his readers. Wordsworth also described carefully, but his views were often colored

by a preconceived philosophy, psychology, and theory of language. Indeed, the poet's effort to find philosophy in humble life results in some misinterpretation of his work. Contrary to popular opinion, his rustics are not regenerated by nature alone, and there are no philosophers among them. The philosophy Wordsworth professes to learn from common man is really that with which the poet has endowed him. Wordsworth's early philosophical opinions, however, did not endure. In later years he abandoned nearly all the principles of his youth.

In several respects Crabbe and Wordsworth achieved kindred results. Highly individualistic in style, they wrote at times in the simplest language. Without theory, Crabbe often outstripped Wordsworth in employing the language of prose in poetry. In social thinking they agreed that the poor should not be confined in institutions. But both eventually concluded that these unfortunates occupied their destined place in the universal scheme and that the status quo must be preserved.

The chief value in studying these poets together appears not in their occasional agreement, but in the frequent disparity in their views. Crabbe is objective and iconoclastic; Wordsworth is egocentric and idealistic. Crabbe sees disintegration and decay in man and nature; Wordsworth emphasizes permanence. Where Crabbe finds vice and crime, Wordsworth sees natural goodness. Placing humble man under the microscope, Crabbe spots his native ugliness and moral failings in a merciless light. Viewing him from a distance as an artist contemplates a landscape through the haze of evening, Wordsworth finds his humble man with features softened and with the unpleasant aspects of his nature suppressed. Thus the two poets, when paired in this perspective, complement each other, providing together what neither could offer alone: a closer approach to the truth about humble man. 229 pages. \$2.86. MicA 55-1423

LANGUAGE AND LITERATURE, LINGUISTICS

A COMPARATIVE GRAMMAR OF THE ALBANIAN LANGUAGE. PART I. PHONOLOGY

(Publication No. 11,058)

Roger Williams Wescott, Ph.D.
Princeton University, 1948

Abstract not available.

149 pages. \$1.86. MicA 55-1424

LANGUAGE AND LITERATURE, MODERN

MAXWELL ANDERSON: THE PLAYWRIGHT AS PROPHET

(Publication No. 12,097)

Mabel Driscoll Bailey, Ph.D.
State University of Iowa, 1955

Chairman: Professor Charles T. Miller

This dissertation presents critical studies of twenty-six plays by Maxwell Anderson with particular reference to the author's own dramatic theory as set forth in his book *Off Broadway*.

The fundamental principle by which Maxwell Anderson's artistic practice is governed is the conviction that drama is concerned with ethical issues. "Excellence on the stage is always moral excellence," he says. Consciously or unconsciously the playwright is communicating a "message" to his generation.

Obviously this view is at variance with one of the dominant critical tenets of the present century; namely, that theme is merely one of the many technical devices which operate severally and together to produce the aesthetic effect. Mr. Anderson's view of theme is the traditional concept that theme is something distinctly different from the other elements of the artistic construct, that it is the author's vision of meaning, that the theme is embodied in the work of art.

Yet Mr. Anderson's statement and application of this principle is not a mere reiteration of an old critical dogma. He is thoroughly modern in his recognition of the fact that the communications of an artist are different in kind from those of the scientist or the philosopher and can be made only by artistic means. He is impartial in his use of old and new means.

This study, then, is an examination of the theme play in its modern setting. The plays are grouped according to the themes which the author has explored: love, war, justice, power, freedom, religious faith. But the explication and evaluation of the embodiment of these themes takes full advantage of the more precise instruments for determining technical excellence which have been evolved by contemporary criticism. The study reveals that Maxwell Anderson, though actuated by an artistic principle which some critics regard as a handicap, has nevertheless produced plays of genuine artistic merit, plays which in their number, variety, and originality earn for their author the right to his position as one of the foremost playwrights of the present century.

191 pages. \$2.39. MicA 55-1425

STENDHAL AND THE IDEOLOGUES

(Publication No. 11,926)

Albert Harry Berrian, Ph.D.
New York University, 1954

Research Adviser: Professor Richard A. Parker

The philosophy of the Ideologues represents a continuation of the wave of rationalism that accompanied the decay of the theological, sociological, and political foundations of the "ancien régime." Ideology carries on the traditions of the Encyclopedists. This includes an involvement of Ideology with revolutionary idealism. Psychologically, Ideology takes its point of departure from John Locke, who studied the individual as a product of sensations and perceptions. Coupled with the Lockian view is that of the eighteenth century "philosophes" who considered the human being as a primarily psycho-physical mechanism.

Stendhal became acquainted with Ideology in an intellectual and personal way. He studied at the Ecole Centrale, whose spiritual foundations may be observed in the *Eléments d'idéologie* of Destutt de Tracy. His maternal grandfather, Henri Gagnon, was associated with the Ecole Centrale of Grenoble in an administrative capacity. Destutt de Tracy's works served as Stendhal's Bible, as is evidenced by Stendhal's letters to his sister, Pauline, and in his account of his relationship with Destutt de Tracy in his *Souvenirs d'égotisme*.

In his early writings, Stendhal gives evidence of a sense of documentation, classification, and scientific inquiry. This exacting approach, linked with a profound psychological examination of the individual, is a characteristic of the Stendhalian method. A review of the *Projet* and the *Grammaire*, the first two books of the *Eléments d'idéologie*, reveals the source of these techniques.

A trademark of the Stendhalian novel is its presentation of internal conflicts and its emphasis upon the exercising of the individual Will as a means of resolving these conflicts. The characters in a Stendhalian novel are basically the sum total of their problems aired through introspection, a violent sense of self, and a struggle to achieve personal happiness at all costs. A justification for introspection, egotism, and a search for happiness is found in the ethical system of the eighteenth century philosophers and in the *Projet*.

The heroes and the heroines of the Stendhalian novel are almost all Ideologues, preaching their beliefs subtly or openly. They are analytic and logical in the way of the Ideologues. That is to say, the principal characters of Stendhal explore themselves; maintain a psycho-physical view of their own organism and the organism of their fellow man; observe civilization from a strictly economic, political, and ethnographic viewpoint; insist that love is the supreme "bonheur;" and establish themselves as materialists. This explicitly and implicitly means the exclusion of all mystic and spiritual thinking on the part of his characters.

The characters of Stendhal have a rationale behind

their thoughts and actions, are psychologically motivated, and are creatures of logical reflection. There are times, nevertheless, when the artistic temperament of Stendhal gains the upperhand and his critical temperament is suppressed. It is precisely this temperament that makes Stendhal a novelist, and it is this temperament which explains why the usually calculating Julien Sorel shoots Madam de Rênal and the generally self-possessed Fabrice commits an unnecessary murder.

It can be stated in the light of the evidence of this thesis that the capacity of Stendhal was widely assisted by ideologic principles and by Destutt de Tracy, who was a personification of these principles. Stendhal took the material of Ideology, brought his imagination to bear upon it, and transformed it into artistic "chef-d'oeuvres." Finally, it is certain that the creative works of Stendhal can be properly analyzed and explained only if a serious review is made of the impact that the Ideologues in general, and Destutt de Tracy in particular, exerted upon him.

164 pages. \$2.05. MicA 55-1426

VALLE-INCLÁN AS POET
(VOLUMES I AND II)

(Publication No. 12,008)

Catherine Marshall Borelli, Ph.D.
The Ohio State University, 1954

Adviser: Stephen Gilman

The literary production of the Spanish writer Ramón María del Valle-Inclán (1866-1936) consists of a certain number of novels, some volumes of short stories, some plays and three volumes of poetry. Many critics have concerned themselves with his novels, his short stories and his plays. Very little has so far been said or written about his work in verse.

This dissertation treats the art of Valle-Inclán as a verse-writer.

Virtually all the poems of this eminent Spanish author are to be found collected in three volumes: *Aromas de Leyenda*, *El Pasajero* and *La Pipa de Kif*. The composition of these three groups of poems corresponds, in our opinion, to three distinct, successive periods in the artistic experience of their author. For this reason these works are here presented in three separate chapters.

The poet expressed himself on the subject of aesthetics in a treatise (*La Lámpara Maravillosa*), in the preface to a volume of short stories (*Corte de Amor*) and in a conversation with Gerardo Diego. Since these opinions seem to us extremely useful in the interpretation of certain aspects of Valle-Inclán's poetic production, our first chapter is dedicated to this subject.

Towards the end of his artistic career, Valle-Inclán republished his three volumes of poems, making considerable changes in the text and in the arrangement of the compositions. This resulted in a

single volume: *Claves Líricas*. Even earlier, individual poems had undergone certain changes in the various editions. In Appendix I, we present (and even here we believe that this is the first time that such a compilation has been made) the complete list of the variants. We consider that this list is of real utility in showing the character of Valle-Inclán's poetry.

In Appendix II, there is a brief study of the five plays which the author wrote in verse: *Cuento de Abril*, *Voces de Gesta*, *La Marquesa Rosalinda*, *La Enamorada del Rey*, *La Reina Castiza*.

Finally, in Appendix III, there is a study of a certain number of verse fragments which are to be found in the prose works, giving further evidence of the poetic technique of the writer.

Valle-Inclán lived and grew up in the cultural atmosphere which is usually known as the Generation of 98. His early poetic works followed the trend of Rubén Darío and in his youth Valle-Inclán professed himself an enthusiastic believer in the tenets of Modernism. With the passage of time, however, his literary experience gradually acquired greater autonomy. He passed from an initial pastoral-folkloristic moment to a certain mystical experience. Greater maturity as an artist then dictated a later attitude, full of sarcasm, to which he himself gave the name *esperpento*. These three moments in the art of Valle-Inclán are very evident in his prose works. The three volumes of poetry seem to be located at well-defined points along this trajectory which, while it suggests the breadth and also the limitations of the poet, also clearly indicates his growth.

Special attention has been given to the technique of the individual poems in the three groups. This study includes imagery, versification, rhythm, rhyme, and such linguistic features as choice of vocabulary and position of adjectives.

The conclusion points up the quality of this great artist, who also knew how to be a real poet.

458 pages. \$5.73. MicA 55-1427

THE INFLUENCE OF FRENCH REALISM AND NATURALISM ON GEORGE MOORE'S EARLY FICTION

(Publication No. 11,928)

Milton Chaikin, Ph.D.
New York University, 1954

Research Adviser: Bruce McCullough

At the beginning of his career as a novelist, Moore depended upon his sources rather heavily. The close parallels between the novels he imitated and his own novels enable fairly certain identification of the former. As his skill developed, however, and he found it less necessary to borrow language and detail, similarities become less evident.

An examination of Moore's early development reveals in the first place the influence of Balzac. It is prominent in Moore's first novel, *A Modern Lover* (1883), for which *Les Illusions perdues* (1839-42) was

drawn upon; it appears again in *A Drama in Muslin* (1886), a study of the province in the manner of Balzac; and it is recurrent in subsequent work. Whatever moral overtones are present in Moore's fiction are derivative from this French author. The connoisseurship in matters of love, the disdain for celibacy, the use of money as a narrative motif, and occasional physiognomical description may also be traced to the same source.

Zola's influence upon Moore has been more apparent than Balzac's. It is to be found importantly in *A Modern Lover*, but Moore's second novel, *A Mummer's Wife* (1885), is thoroughly Zolaesque. Many of the details and mannerisms derive from this French naturalist. The triangle situation, generally ascribed to the inspiration of Flaubert, was borrowed from Zola's *Therese Raquin* (1867). Furthermore, it was Moore's first, and last, naturalistic novel, if by naturalistic fiction is meant that type of which the basis is materialistic determinism and of which the narrative approach is principally documentary.

A Mummer's Wife was Moore's last naturalistic novel in the "scientific" sense, for he very soon became discontented with scientism as foundation and documentation as method for his fiction. As a hedonist, however, he continued to follow Zola in insisting on the continuity of man and nature, on the goodness of natural impulses, and on the badness of artificial restraints of these impulses.

From Zola, too, Moore learned the style he used in his first few novels. The "fugal" method of scene development, of which repetition and variation of themes are the principal ingredients; lush description; sensory impressions; physiological processes; and crowd scenes - these are some of Zola's procedures that Moore used in his own early fiction.

Between 1886 and 1892, Moore avoided the technique of full documentation, because it was too "external," and attempted a more intellectual, psychological, and subtle narration - with Pater, Huysmans, and Turgenev as models. Because his efforts in this direction were largely unsuccessful, he returned to the documentary method in *Esther Waters* (1894). Although this novel is often said to have been written under the influence of the Goncourts' *Germinie Lacerteux* (1864), Moore was the disciple of Flaubert at this time, and it is Flaubert whose presence is felt in *Esther Waters*, particularly in the passages expressing a sense of fatalism. The fatalism, however, is tempered by that quality which is the issue of Esther's successful struggle with a hostile environment.

216 pages. \$2.70. MicA 55-1428

THE GENESIS OF SOCIAL IDEAS
IN SINCLAIR LEWIS

(Publication No. 11,929)

Arthur B. Coleman, Ph.D.
New York University, 1954

Adviser: Oscar Cargill

This study is concerned with the origination, generation, development, and changes of the social ideas of Sinclair Lewis. In keeping with this purpose, much of this dissertation deals with the amount and character of influences on Lewis exerted by the ideas of H. G. Wells, Hamlin Garland, Thorstein Veblen, G. B. Shaw, and H. L. Mencken. An important objective of this study, then, is to provide as full an account of the social ideas of Wells, Garland, Veblen, Shaw, and Mencken as necessary in order to facilitate a comparison with the full body of Lewis's ideas, as found in his novels; and to determine the amount and kind of influence the social ideas held by these men had in the formulation and development of Lewis's work. Finally, all extensions, variations, modifications, or changes in Lewis's social point of view are presented and discussed.

First Phase: Formulation - demonstrating how in this period (Our Mr. Wrenn, The Trail of the Hawk, The Job, The Innocents, Free Air, Main Street, and Babbitt), Lewis reveals a familiarity with and admiration of the social, political, economic, and ethical opinions of Wells, Garland, Veblen, Shaw, and Mencken.

Second Phase: Crystallization - demonstrating how in the novels of this period (Arrowsmith, Mantrap, Elmer Gantry, The Man Who Knew Coolidge, Dodsworth, and Ann Vickers), Lewis takes the social judgments which he had formulated during the previous years and applies them in evaluating the state of affairs of specific social disciplines such as medicine, religion, business, and social work.

Third Phase: Culmination - demonstrating how in the novels of this period (Work of Art, It Can't Happen Here, The Prodigal Parents, Bethel Merriday, Gideon Planish, Cass Timberlane, Kingsblood Royal, The God-Seeker, and World So Wide), Lewis, in some novels, maintains his former social point of view - generally critical of American values - and in other novels reveals a completely opposite social point of view - generally appreciative of those American values he had always satirized and debunked.

254 pages. \$3.18. MicA 55-1429

GEORGE MEREDITH'S WOMEN:
A STUDY OF CHANGING ATTITUDES
IN VICTORIAN ENGLAND

(Publication No. 11,930)

Elizabeth Adams Daniels, Ph.D.
New York University, 1954

Supervisor: Professor Bruce McCullough

This thesis considers Meredith's attitudes towards women in the light of his total philosophy.

Meredith's views hold that nature is instinct with a purpose that guides evolution. This purpose, or "the earth spirit," is immanent reason, the essence of nature. Out of it proceed brain and man's spirit; out of natural impulses come values. Spiritual values are therefore the product of slow evolution and any stoppage of change hampers destiny. Society develops rigidities which, interfering with change, must be laughed out of existence by constant intelligent criticism. Woman more than man, Meredith believed, keeps her affinity for the "earth spirit." Anything that antagonizes her natural predisposition must be considered harmful to human progress.

Against this conception of life, Meredith's views of women take shape. His belief that woman's conduct in society must be unrestrained follows his basic premise that woman is in touch with nature. The heroines of his novels, unlike many preceding heroines of fiction, represent the clash of instinct and nature with conventional society, which latter in his novels appears in the form of excessive egotism and sentimentality. Women's problems all have to do with this clash. Since marriage is the institution which affects women most in his culture, the married lives of his heroines involve constant struggles to find freedom from stultification.

Believing in woman's energy, Meredith took issue with many social practices affecting women. He criticized the faulty Philistine notions of virtue and propriety which dogged his age's morality; and he evolved a franker sexual ethic. He advocated experience on all levels for women: physical, emotional, and intellectual. Meredith's novels and some of his poetry employ thematically the mental stress, search for outlets, and legal complexities of women in difficulties. He concentrated on woman's feelings and inner conflict in such a detailed fashion that he may be considered to have anticipated in this connection certain devices of the stream-of-consciousness technique. In handling his heroines, Meredith suggested both what was true of and wrong with woman's rôle in his society, and what the ideal rôle might be.

Meredith made considerable use of autobiographical elements. This dissertation examines the use of several intellectually-liberated women whom he knew as his sources for the robust Meredithian type of heroine. German Romanticism and the writings of Thomas Love Peacock also contributed elements to his complex idea.

The Preface of this dissertation clarifies Meredith's general views as they make implicit his views on women.

Chapter One investigates Meredith's vantage point in viewing his time. It considers general trends and Meredith's particular orientation to them. It suggests the large range of autobiographical elements used in his fiction.

Chapter Two studies the evolution of Meredith's heroine: her looks and nature, her mental makeup as a complex learning process, her real-life counterparts, the nature of her problems.

Chapter Three considers the elements of sexual ethic and moral attitude which Meredith felt might be reformed to lead towards a more balanced relation of the sexes.

Chapter Four investigates the legal, economic, and social problems which Meredith saw as stemming from the basic moral misarrangement. It takes up phases of his indictment of Philistine standards of respectability.

Chapter Five studies Meredith's conception of the process of emancipation. Through struggle, first with self and then with society, women can sometimes gain freedom when they have courage to seek it. Yet Meredith suggests, in the number of heroines who must leave their conventional environments to make independent lives elsewhere, the seriousness of Victorian repressive tendencies.

Chapter Six reinterprets, in conclusion, the meaning of Meredith's views on women as a measure of his total philosophy.

217 pages. \$2.71. MicA 55-1430

**TOM JONES: A GENEALOGICAL
APPROACH, FIELDING'S USE OF
TYPE CHARACTERS IN TOM JONES**

(Publication No. 11,931)

John Roland DeBruyn, Ph.D.
New York University, 1954

Adviser: Professor McCullough

In each of the seven characters here discussed Fielding has fulfilled some particular aspect of his total comic purpose, both as restricted to the basic plot and as expanded to illuminate all human life and manners. While Fielding's characters were enriched from everyday observation, sometimes, perhaps, based on real people, it seems reasonable to assume that they were shaped and strengthened by use of conventional molds.

Tom Jones seems based upon the rakish hero of English comedy, good at heart but reckless, almost completely transformed and captivated by the love of a devoted and persistent mistress. He is no witty sophisticate but a natural young country fellow, whose treatment suggests the culmination of new tendencies heralded by the comedies of George Farquhar. His ingenuous recklessness is shown to confirm Fielding's prevailing thesis that true virtue is unstudied and spontaneous. With picaresque richness of incident and epic sweep Tom, the structural center of the book, is transferred from country to town, a means

to the exposure of a wide variety of rogues, fools, and pretenders.

As a contrast and complement to the spontaneous idealism of his hero, Fielding has created Partridge, using the materials of the picaresque hero's man, especially Cervantes' Sancho, but most conspicuously those of the pedant. In contrast with the unassuming Tom, Partridge is a conspicuous example of human vanity.

To accentuate the unpretentious virtue of his hero, Fielding has created Blifil. While Fielding obviously detests pious hypocrisy in itself, it seems likely that his conception was shaped by the traditional hypocritical villain, notably Molière's Tartuffe, widely adapted in England, significantly by Fielding himself. Like Tartuffe, Blifil, full of pious professions, imposes on a family circle, his hypocrisy variously and by degrees detected, Allworthy, like Orgon, the most gullible victim. But Fielding's loathing for his villain is less restrained than is Molière's.

Sophia Western is virtuous, but understanding and tolerant of a difficult parent and an erring lover, whom she must captivate and convert. The traditional English comedy heroine seems to have been a likely model, but Sophia is softer and more womanly than most of this type. In her lively and comical presentation it is plausible and profitable to assume that she was Fielding's culminating protest against Richardson's Pamela.

As the spokesman for rural humanity Squire Western emerges. He is presented with the traditional attributes of the fox-hunting Tory squire, but with greater than customary warmth and humanity because Fielding obviously admires his vigor and because Sophia's devotion to her parent must seem plausible. His vices and follies will seem more deplorable if possessed by a sympathetic character.

Aunt Western satisfies the need for a suitable foil to the stubborn and tempestuous squire and an only partially helpful assistant to Sophia in her efforts to achieve emancipation. Fielding has apparently drawn upon the character of the female pedant; and to spice her relationship with the squire, a determined Jacobite, has supplemented her conglomeration of unwomanly accomplishments with a preposterous Hanoverian prejudice, so that she seems based, in addition, on the coffee-house politician.

Lady Bellaston is the focal character of urban society. Because London high-life is to Fielding prevaillingly dull, and because Tom requires additional proof of his inherent goodness, he has made use of the traditional elderly coquette, but makes her bolder, fiercer, and more aggressive than most of her ancestors, less dependent in her hypocrisy on professions of virtue or piety.

All these characters except the female pedant Fielding had earlier created. But it is in his transformation of conventional materials that lies the clue to his greatness. 243 pages. \$3.04. MicA 55-1431

STEPHEN CRANE'S SOCIAL OUTLOOK AS REVEALED IN HIS WRITINGS

(Publication No. 12,150)

Andrew Weston Hart, Ph.D.
Michigan State University, 1954

This thesis attempts to determine the social outlook of Stephen Crane through an examination of his writings. The Introduction defines the term "Social Outlook" and discusses the milieu in which Crane lived and wrote, and its influence upon his work.

The next eleven sections examine Crane's poems and stories in order to uncover as many facets as possible of his social thought. In the Conclusion, the information thus obtained is fitted together into a comprehensive creed.

Crane's poetry reveals an antipathy toward orthodox religion and its vengeful God. It shows that Crane himself conceived God to be an aloof being who derives a cruel pleasure from contemplating the world which he created, but does not interfere with it in any way. Man is characterized as basically irrational and evil, yet capable at times of courageous behavior and often desirous of knowing ultimate truth – a desire impossible of fulfillment. The universe is pictured as totally indifferent to man, and each individual appears completely isolated from all others.

The Red Badge of Courage develops many of the ideas presented in Crane's poetry. In particular, it stresses that men's actions are largely motivated by the desire to appear well before others and to gain a secure position within the social hierarchy. Crane indicates that man can best achieve these goals when the group is threatened by great danger. At such times each individual feels linked to his companions by strong bonds of friendship and solidarity, gains an accurate knowledge of his own capacities and limitations, and comes to realize that seemingly impossible tasks can often be accomplished through cooperative effort.

The Sullivan County Sketches portray man as egotistical, extremely romantic, cowardly, and only partially able to control his own destiny. They also reflect Crane's disdain for superstition.

Maggie and George's Mother tell of the failure of two individuals who attempt to attain status in the social group. Maggie's failure is caused by her ignorance of any life other than that of a slum dweller, while George's stems from the lack of suitable ways for him to prove himself.

"An Experiment in Misery" and "The Men in the Storm" criticize victims of social injustice for not fighting back against society. The stories indicate that such persons possess the power to compel society to redress their grievances, but are unable to cooperate with one another to the extent necessary to employ it successfully.

"The Open Boat" and "A Man and . . . Some Others" restate Crane's belief in the efficacy of courage. They make the point that cooperation and courageous behavior during a period of crisis enhance, but do not guarantee, any particular individual's chances of surviving it.

"Twelve O'Clock" and "The Blue Hotel" illustrate the indifference of the universe and show how a series of insignificant events can lead to serious or even fatal final consequences. The latter story also shows how failure to understand the true nature of society can lead to isolation and death.

Minor Stories with Social Themes have as their themes the indifference of the universe, man's callous disregard of the sufferings and misfortunes of his fellows, and the power of forces making for social conformity. One, "A Self-Made Man," satirizes the rags-to-riches American success story and indicates that chance, rather than merit, determines an individual's destiny.

The Monster and The Whilomville Stories deal with society's hostility toward and persecution of those persons who differ from the majority. Both stories reveal that Crane regarded Negroes as lazy, easily frightened, fond of loud garments and fancy language, but also capable of behaving heroically at times. In The Whilomville Stories Crane depicts children as possessing essentially the same traits as adults, hence makes the point that human traits are hereditary, rather than acquired.

Crane's social outlook, as stated in the Conclusion of this dissertation, is basically naturalistic. Its chief weakness is that it places too much emphasis upon man's faults while largely overlooking his very considerable virtues.

189 pages. \$2.36. MicA 55-1432

THE LITERARY CAREER OF JAMES HERVEY

(Publication No. 11,885)

Flora McLaughlin Kearney, Ph.D.
University of Maryland, 1954

Supervisor: Professor Alfred O. Aldridge

The importance to English literature of James Hervey (1714-1758) lies in his amazing popularity. A retiring country rector, he combined theological thought with esthetic form in order to popularize evangelical religion. Sympathizing with those Methodists who followed George Whitefield, he dedicated his arts of persuasion to supporting the Calvinistic doctrine of imputed righteousness. Hervey assured himself of readers by adopting popular eighteenth-century themes, modes of rhetoric, and literary genres. Although his most influential work, Meditations and Contemplations, was phenomenally successful in Great Britain, on the Continent, and in America, the intelligentsia did not, as a rule, care for his productions. Most of his admirers were among the common people, who were in the throes of religious revival and therefore particularly susceptible to Hervey's evangelical sentiments.

Because the eighteenth century loved Gothicism, sensibility, sublimity, and elegance, Hervey adapted these themes to his theological notions. In "Meditations among the Tombs" he writes on the inevitability of death, the horrors of the grave, and the terrors of

the last judgment. In all his works he addresses himself to the sensibilities. When depicting a death-bed, a burial, or a sinner in the agony of repentance he strives to evoke feelings of anguish; in describing a parterre, a cascade, or a belvedere he attempts to produce feelings of delight. When considering the stars and other awesome natural phenomena he satisfies his readers' tastes for contemplating the sublime. In his style he tries to gratify the eighteenth-century fondness for elegance, but in attempting a graceful, polished manner he frequently achieves too intense an effect and becomes florid and bombastic.

In literary form also Hervey catered to contemporary taste and chose for this purpose the meditation, the dialogue, the letter, and the sermon. In his meditations he united various familiar strains of devotional literature, both Catholic and Protestant, sacred and secular. He selected the dialogue form for *Theron and Aspasio* in order to refute, by means of a precise juxtaposition of contrasting theological systems, contemporary deistic and Arminian views. His letters are also primarily theological and didactic. When he includes description or news, he does so for the purpose of teaching a spiritual lesson.

Hervey's subject matter other than tombs concerns science, gardening, and theology. He charmed the reader by portraying the various formal and artificially "natural" gardens on the estate of his character Theron and advanced his religious arguments by describing the revelations of the physical universe which are visible through a microscope or telescope. These devices were bound to be popular in an age when men were becoming scientific virtuosi and landscape gardeners.

In all of his writings and especially in *Theron and Aspasio* Hervey argues against the strongly rational, Arminian, and unitarian elements in eighteenth-century religious thought. In so doing he expounds the doctrine of imputed righteousness, according to which a Christian, recognizing the imperfection of his own good works, may depend upon the righteousness of Christ to make up for his deficiencies. John Wesley feared that this doctrine would supplant obedience to the moral law and published a letter to his followers cautioning them against antinomianism. Hervey replied in *Aspasio Vindicated*, which increased the already existing division between Calvinistic and Arminian Methodists.

Because, in the opinion of the uncritical, he successfully integrated popular literary forms, themes, and modes of rhetoric, Hervey was widely read, translated, praised, and imitated throughout the century. His work may be regarded as a partial index to eighteenth-century taste.

240 pages. \$3.00. MicA 55-1433

PROMETHEUS OF DUBLIN: A STUDY OF THE PLAYS OF SEAN O'CASEY

(Publication No. 11,937)

David Krause, Ph.D.
New York University, 1954

Adviser: Professor David Greene

Sean O'Casey is one of our most neglected living dramatists. Only four of his ten plays (he is now writing his eleventh, at the age of 74) have received major productions in Dublin, London, or New York. Only a few isolated, and often misleading, attempts have been made by critics and scholars of the drama to consider some of his plays seriously. As recently as 1953, Joseph Wood Krutch, in his *Modernism in Modern Drama*, devoted several perfunctory sentences to O'Casey, as an afterthought at the end of a chapter on Synge. Mr. Krutch merely observed that for him O'Casey's plays are confused and pessimistic. The British critic Raymond Williams, in his *Drama From Ibsen To Eliot* (1952), dispensed with O'Casey in a Note, again at the end of a chapter on Synge, insisting that his plays suffer from linguistic abuses and the limitations of naturalism.

It is one of the basic assumptions of this study that O'Casey is more than a footnote to Synge; he stands on a par with Synge. In fact, he has carried on Synge's synthesis of "richness and reality." Synge believed that the dramatist must create the vivid reality of life by using a rich and copious language spoken by the people - "the rich joy found only in what is superb and wild in reality." This synthesis closely parallels Wordsworth's famous theory of diction, and Synge fulfilled it in his plays about Irish peasants. O'Casey fulfilled it by writing plays about the wild reality of life in the Dublin slums, using the rich idiom of the urban "peasants." He has brought the joy of poetry back to the drama. O'Casey's attitude toward the human condition is not pessimistic or naturalistic; it is one of compassion and faith in man. His main characters, particularly the women, struggle heroically against the economic and moral slums of modern life; they are symbolic of man's enduring dignity and courage.

The leading characters in O'Casey's first three plays, *The Shadow of a Gunman*, *Juno and the Paycock*, *The Plough and the Stars*, are confronted with moral choices which define the kind of tragedy he is writing. These people are caught in one of the pervasive conflicts of our time, the struggle between private and public commitments, and the condition for tragedy arises whenever someone violates the interdependence between individual and group loyalties. For O'Casey, salvation involves a double act of faith - to self and to society.

O'Casey has never been satisfied to repeat his past successes. He has always moved on, exploring new dramatic forms. (This is not only evident in his later plays but also in his monumental autobiography, still in progress with five volumes completed, in which he employs techniques of the novel and the drama in telling his life story.) In his next four

plays, *The Silver Tassie*, *Within the Gates*, *The Star Turns Red*, *Red Roses For Me*, he combined the non-realistic techniques of Expressionism with those of Realism. These plays might be called modern moralities, for here he dramatized the allegorical struggle between forces of good and evil in the twentieth century. And out of this conflict emerges his "vision" of the good life, his secular epiphany. He continued this theme in his last three plays, all of them comic fantasies, *Purple Dust*, *Oak Leaves and Lavender*, *Cock-a-doodle Dandy*.

In these seven later plays, this vision of the good and free life is O'Casey's symbolic act of faith in man, his Promethean celebration of the "Good, great and joyous, beautiful and free."

308 pages. \$3.85. MicA 55-1434

THE POLITICAL AND SOCIAL IDEAS OF JOSEPH CONRAD

(Publication No. 11,940)

Richard Eugene Lee, Ph.D.
New York University, 1954

Joseph Conrad often had reason to complain that readers wanted to fit his work into neat little boxes labelled "sea stories" or "exotic tales." He might also complain of the reader who would classify him as a political or social thinker, for obviously Conrad was not primarily a political novelist at all.

But exile from Poland and life in an alien country made political preoccupation almost inevitable. Many of Conrad's works have long been noted for their political intentions: *Nostromo*, *The Secret Agent*, *Under Western Eyes*, "An Outpost of Progress," "Heart of Darkness." These stories all have in common an indication of their author's political beliefs and ideas. In all of them he attacks institutions, beliefs, men that are repulsive to him. In some he provides a possible resolution to the problem.

Many of Conrad's other novels and stories are more descriptive, more social than political. The prime intention of the stories lies elsewhere than in the formulation of a strictly political novel. Most of Conrad's Malay tales belong in this class. Yet in most of Conrad's writing political references occur with remarkable frequency.

Conrad's political ideas were conservative, midway between the lawlessness of autocracy and the lawlessness of revolution. He found in England, the land of his adoption, an environment in which his conservative values could have free play. England in his writing stands for the politically stable, the politically equitable and desirable.

The concept of England for Conrad is basic to an understanding of his political philosophy, for nothing must be done to harm the political *status quo* of a conservative country like England. But two major contemporary problems relate to England's stability. One has to do with imperialism, the other with capitalism or material interests.

Conrad gave to both of these problems a great deal

of thought. Imperialism he found to be evil when conducted along national, impersonal, greedy lines. What saves imperialism is "idea." For Conrad the acceptable colonizer is a man like Tom Lingard or the Rajah James Brooke.

Having accepted England with the fervor of a convert, Conrad was, nonetheless, as aware of the moral dangers inherent in material interests as any other author writing in England. *Nostromo* is an analysis of some of the dangers, but this novel does not suggest so much a rejection of capitalism as an understanding of its manifold responsibilities. It serves as constructive criticism.

Conrad saw no reason for rejecting capitalism or imperialism. What he did reject was radicalism, socialism, anarchism, revolutionism. In several novels and stories he aired his views on stupid men with fixed ideas who had the temerity to meddle with social change in the hopes of enforcing their ideas of political atheism or of gaining greedy ends.

That Conrad had little understanding of the political philosophies he attacked made no difference. What he objected to was not a philosophical concept but an actual and highly possible revolution. That threat would remain regardless of the language used in constructing a revolutionary program.

These three interests - imperialism, capitalism, revolution - serve as the backbone of Conrad's political philosophy. Other ideas but fill in or help support these. His views on Russia, derived from personal experience, buttressed his fears of revolution. They made England and conservative politics all the more desirable, for England alone seemed able to avoid the excesses of autocracy and revolt. Russian autocracy in the era of the Tsar as in that of the Communists precluded the possibility that a gifted writer could develop his talents freely and at his own pace.

313 pages. \$3.91. MicA 55-1435

MARK TWAIN AND W. D. HOWELLS: A LITERARY RELATIONSHIP

(Publication No. 11,944)

Robert Jack Lowenherz, Ph.D.
New York University, 1954

Research Adviser: Professor William M. Gibson

For over forty years Mark Twain and W. D. Howells were close friends. They visited each other frequently, maintained a voluminous correspondence between them, collaborated on various literary projects, and often spoke or wrote privately and publicly about each other. This dissertation is a full and detailed account of the personal and literary relationship of the two writers.

Chapter One deals with the personal friendship of Howells and Mark Twain, tracing the history of their long intimacy from its beginning in December, 1869 through the years to Mark Twain's death in 1910. Particular attention is paid to the accurate dating and reporting of the joint activities of the two men; the

accounts by Howells in *My Mark Twain* and by A. B. Paine in his biography of Mark Twain are corrected or supplemented wherever necessary; and various new facts and facets of the personal relationship are brought to light.

Chapter Two deals with three literary collaborations of Howells and Mark Twain. The first of these, a kind of literary round robin known as the Blindfold Novelettes, was a grandiose scheme designed to combine in one composite piece of writing the literary talents of Holmes, Lowell, Mark Twain, Aldrich, James, Howells, Bret Harte, and Warner. After the failure of the project in 1876, Mark Twain revived it with G. W. Cable in 1884, only to be frustrated in the enterprise again. Finally, in 1907, Howells used the old plan in a book entitled *The Whole Family*. In 1881 the two friends "lifted" the idea for a Library of Humor from a Scottish publisher; but after the anthology had been compiled by Howells and Mark Twain and was ready for publication, its appearance was delayed until 1888, at which time it proved to be an even more dismal failure than the Blindfold Novelettes. The third attempt at literary collaboration was a comedy, "Colonel Sellers." When Howells and Mark Twain wrote the play in 1883, their enthusiasm was so great that they planned an entire series of plays together. But one difficulty after another prevented the production of "Colonel Sellers" and even led to a brief quarrel between the two friends. The story of the composition and the attempted production of this dramatic collaboration is in many respects more amusing than the play itself.

Chapter Three treats of Howells as an editor of Mark Twain. An examination of all the published and unpublished material available reveals several facts. While it is true that Howells exercised some restraint upon Mark Twain's treatment of religion and sex and toned down his language, the extent of this editorial censorship was more limited than is generally assumed, and its motive was less Howells's personal squeamishness than an experienced editor's realistic appraisal of what the rigid conventions of the middle class reading public would permit at the time. More important is the fact that Howells was often a positive editorial influence upon Mark Twain; he helped to curb Mark Twain's tendency to violate the spirit of a book by introducing low comedy, burlesque, or inappropriate and irrelevant satire; and, with his own keen interest in literary realism, he encouraged him to write objectively and accurately.

Chapter Four concerns Howells and Mark Twain's critical judgments of each other. In spite of his limitations as a literary critic, Mark Twain perceived and praised two important aspects of Howells's writings - his use of realistic detail and his style. He frequently extols Howells's ability to "photograph" with minute fidelity the scenes and people of real life. Although Mark Twain's criticism of Howells is desultory, informal, and incidental, Howells's criticism of his friend's writings is extensive, detailed, methodical, and remarkably sound. Nor is this criticism uniformly approving and complimentary. Howells not infrequently complains of technical lapses, slovenly plot construction, and the tendency to inject

extravagant comedy or burlesque into a work. Through the years Howells comments repeatedly on the humanitarian spirit of Mark Twain's humor, the characteristically discursive and rambling nature of his style, the thoroughly American provenance of his vocabulary, and the substratum of seriousness and moral purpose in his best works. Specialized studies of Mark Twain's writings by later scholars and critics have confirmed the accuracy of many of Howells's critical perceptions.

An Epilogue deals with *My Mark Twain*. Rambling and often factually inaccurate as the book is, it is Howells's most eloquent expression of his affection for his old friend and a summing up of the relationship from his point of view.

261 pages. \$3.26. MicA 55-1436

STARK YOUNG AND HIS DRAMATIC CRITICISM

(Publication No. 12,152)

Robert M. Lumianski, Ph.D.
Michigan State University, 1955

The general objective in this thesis is to place Stark Young in the whole milieu of the dramatic criticism of the early decades of the twentieth century in the United States. Since Mr. Young has been an educator, play director on Broadway, novelist, dramatist, and critic; since his interests have been very wide and varied; and since this dissertation touches upon all his interests, insofar as they have affected his dramatic criticism, the material has been arranged in four chapters.

I. *His life and works.* Young is a product of the "Old South" cultural tradition in Mississippi and was brought up in it. In tracing his career from his early childhood in Como to the publication of *The Pavilion*, we perceive how the noblesse oblige ideology has been inculcated in Young and how philosophically and psychologically this influenced his subsequent creative and critical activity.

II. *The Man.* An investigation of Young's philosophy of living, art, and education reveals that in philosophy, he is an idealist; in art, he is an aesthetic mystic; and in education he is a believer in the Thomas Aquinas doctrine of education of the whole man.

III. *His dramatic criticism.* Young has been the most serious of the American theatre critics of the past generation. His approach to criticism was unique on Broadway. An analysis of the various kinds of dramatic critics who flourished in America yields four classes, namely, journalistic, stage, drama, and theatre-drama. Young is the sole theatre-drama critic. As evidenced by his periodical and newspaper articles, as well as his books, Young's method was that of the aesthete whose major concern was to reveal the elements of art in theatre performance, and at the same time evaluate the literary worth of the play at hand.

IV. *Actors and acting.* Having a sympathetic understanding of the actor, he devoted much of his

criticism to an investigation of the acting art. His numerous articles on the art of acting show that he is neither of the representational Stanislavsky school which advocates the actor must play as though there were no audience; nor is he a follower of the presentational school that presumes as with music, an audience is implicit in the art. He stresses only that the test must be based upon how well the actor creates the "idea" and how well the audience realizes it is art at which it is looking, and not nature.

In his genuine love for the theatre as an institution; his integrity as a critic and artist; and his ability as a thinker, Stark Young is the most profound theatre-drama critic of his generation.

The appendix contains an extensive bibliography of his works and works about him, which is as complete as the writer could make it.

342 pages. \$4.28. MicA 55-1437

THE JAPANESE INFLUENCE ON ENGLISH AND AMERICAN LITERATURE, 1850 TO 1950

(Publication No. 11,988)

Earl Roy Miner, Ph.D.
University of Minnesota, 1955

Adviser: William Van O'Connor

Before 1850, the Orient provided English writers with various images by which Western culture might be examined and helped establish relativistic standards which later led to Impressionism. After the reopening of Japan in the Eighteen-Fifties, American writers regarded it as part of America's new cultural — and commercial — heritage. Bayard Taylor and others visited Japan; Hawthorne, Lanier, and Longfellow reacted variously; but Whitman and Ernest Fenollosa responded most fully by rhapsodizing on the mingling of East and West in intercultural contact.

Nineteenth-century English writers reacted differently. Japan unsettled the firm if ambivalent Victorian beliefs, leading Sir Edwin Arnold, Kipling, and Meredith to re-examine Victorian assumptions. Such other writers as Henley and Noyes were only superficially touched by Japan.

Feverish interest in Japan arose first in French Japonisme and the development of critical and artistic Impressionism which Whistler and Symonds established in England. Japanese prints were extolled for representing coloristic, compositional, and amoral criteria which were quickly propounded by Whistler, Wilde, and others, and opposed by Swinburne and Ruskin. This new interest in Japan also led travellers to write on Japan and novelists to make comparisons between Japanese and Western culture. This stylistic device of the "Japanese simile" was widely employed — by Crane, Howells, London, Norris, Fuller, Dreiser, and James. While lesser novelists responded with sentimental, pseudo-Japanese fiction, Lafcadio Hearn praised Japanese religion and civilization with a fine Impressionistic style in writings which popularized Japan and led post-Georgian poets to reconsider the Orient.

The French and Hearnian interpretations of Japan helped T. E. Hulme and Frank Flint to define literary issues — and stimulate Ezra Pound. Pound defined imagistic technique largely in terms of Japanese poetry, devising a "super-pository" technique used widely by him and others. Fenollosa's writings on the "ideogram" and Nō drama stimulated Pound to other imagistic and narrative techniques for his poetry.

Amy Lowell exploited Japanese art, history, and prosody for her poetry, and she, Flint, Aldington, Fletcher, Aiken, and many others heeded Pound's injunction to follow "Whistler and the Japanese." Wallace Stevens assimilated Japanese art and poetry in his verse, and such other poets as Noguchi, Fijita, Adelaide Crapsey, Ficke, Bynner, and Binyon did also. Blunden, Plomer, Vines, and Empson visited Japan and left records in poetry and prose.

The Japanese craze led Gilbert and Sullivan to satire in *Patience*, but they half-capitulated to the popular pseudo-Japanese stage-types in *The Mikado*. "Loti's" *Madame Chrysanthème* established a literary motif of desertion in many novels and plays which culminated in Long and Belasco's *Madame Butterfly*, Puccini's opera, and other increasingly realistic, if exotic, "Japanese" dramas. Of the various attempts by Sir Edwin Arnold, Masfield, and others to emulate or interpret Kabuki, Sergei Eisenstein's use of this genre for cinematic theory and technique probably represents the finest Western understanding of Kabuki.

Various attempts have been made by Bottomley, Binyon, Sturge Moore, S. Foster Damon, Wilder, Claudel, Brecht, and Paul Goodman to imitate Nō, but no writer has succeeded as well as William Butler Yeats who modelled his mature dramatic work on Nō and encouraged others to do likewise. He emulated Nō in its use of legend, stylization, aristocratic dignity, poetry, and dance in his "Noh" plays and exploited these borrowings for techniques he employed in poetry and which others imitated.

Japan was most important to English and American artists and writers from 1850 to 1950 in developing artistic criteria, technique, and forms which helped make modern literature what it has been — so much so that Japan was central to the finest poetry of the age, that of Yeats and Pound, as well as to the work of countless minor writers.

504 pages. \$6.30. MicA 55-1438

ARTEMUS WARD; A CRITICAL STUDY

(Publication No. 12,120)

John Quincy Reed, Ph.D.
State University of Iowa, 1955

Chairman: Professor John C. Gerber

Charles F. Browne, or Artemus Ward, one of the most popular of nineteenth century American humorists, is a transitional figure in American humor. Not only was he the first of a group who shifted the focus of humor from a local region to the nation as a whole, but he also stands at the head of a long succession of

humorous lecturers. Born in Maine, he learned the printing trade and then worked for several years as a compositor on the Carpet Bag, where his first attempts at humorous writing were published. Leaving Boston, he spent a number of years in Ohio as a journeyman printer and as local editor of the Toledo Commercial and the Cleveland Plain Dealer. During his years in the Ohio country he tended to adopt many of the attitudes and ideals of the West and to become a spokesman for that region. Going to New York from Cleveland, he worked for a time on Vanity Fair and then took to the platform as a humorous lecturer. After lecturing successfully in America for five seasons, he presented his lecture in England for a season before his death there in 1867.

Browne's humor was commonplace and typical of contemporary newspaper humor until he invented the character of Artemus Ward while he was local editor of the Plain Dealer. Adopting the language and viewpoint of his creation, who is characterized as an itinerant showman, Browne wrote a series of letters for the Plain Dealer, Vanity Fair, and Punch in which he commented, usually in a genial manner, upon almost every aspect of the life of his times. His social criticism was particularly directed against the overzealousness of reformers, the excesses of nationalism and patriotism, and the bizarre aspects of unorthodox religious sects. His chief contribution to literary criticism is a series of burlesques in which he ridiculed the current deluge of sensational fiction and melodramas.

Browne's humor was national, rather than regional in nature. His writings and lectures display some of the characteristics of the frontier and Southwestern schools of humor as well as a strong Yankee influence. He utilizes composite American speech in his writings, and his alter ego, the old showman, is a mixture of national types. Of the humorous devices which he employs in the Artemus Ward letters, cacography is the most outstanding, but he also effectively puts to use most of the other devices of the professional humorists of his age. His humorous lectures were characterized by a deliberate lack of organization, fantastic chains of association and a "deadpan" delivery.

Browne's success in his own day was phenomenal. His Artemus Ward letters were widely read and reprinted in newspapers and magazines all over the country, and his lectures were well attended both in England and America. His success as a humorous writer and lecturer not only motivated other humorists to adopt many of his techniques, but the enthusiastic reception which he received in England helped to increase respect in America for our native humorists. Today, chiefly because many of his techniques are no longer fashionable and because much of his humor and satire is of a topical nature, Browne has been nearly forgotten by the American public.

Despite his loss of popularity with the general public, Browne's works are of interest to the student of American literature. Not only is he an outstanding representative of native American humor, but he is also important as a social and literary critic. His ridicule of the romantic idealism and genteel culture

of the East is symptomatic of a Western revolt against the established tradition, and his burlesques of popular fiction helped to discourage sensationalism and sentimentality in fiction and to prepare the way for the rise of realism in American literature.

272 pages. \$3.40. MicA 55-1439

THE CONTEMPORARY BACKGROUND OF LYRICAL BALLADS, 1785-1799

(Publication No. 11,950)

Seymour Reiter, Ph.D.
New York University, 1954

Adviser: Professor Edward L. McAdam, Jr.

The British periodicals of the late eighteenth century reflected the taste and interests of the literate public, the critical standards of the time, and poetic practice. Chiefly through documentation from these sources, this study attempts to establish that the Romantic movement won a dominating position in England during Wordsworth's formative years.

From the point of view of subject matter the re-discovery of nature, with attendant emotional and imaginative values, is unquestionably the most important aspect of Romanticism. That rediscovery was popularly made before 1798. Probably the two most important causes of the emergence of Romantic characteristics in nature poetry were the picturesque movement and science. There was an equally popular interest in earlier times and other places: in the primitive and medieval, in Elizabethan literature, in ancient Greece, in the Orient, and in contemporary travels. During the years 1785-1799 poets, responding to public taste and interests, ranged through time and space for subject matter; and the exotic quality of that material led them to exercise their imagination. At the same time the public and critics learned to respond favorably to imaginative works. Other material now thought of as Romantic, ranging from war to fairyland, also engaged England's interest.

Along with Romantic subject matter, certain qualities characteristic of the movement emerged: sensibility, melancholy, and subjectivity. Subjectivity arrived last in poetry, and was probably a psychological consequence of the other two qualities, which had come together after having developed fairly independently. Both poets with important reputations and significant magazine versifiers wrote subjectively.

In the interests of imaginative expression, poets on occasion rejected Augustan poetic diction for real, even colloquial, language; and they increasingly discarded the long-dominant heroic couplet. As poetic practice rapidly changed, considerable dissatisfaction with the old critical criteria developed. Instruction as a chief end of poetry fell into almost universal disrepute; and intuitive taste, imagination, and feeling supplanted reason and its attendant rules. Many of the new ideas that were formulated concerning the aim and nature of poetry, and of what constituted a poet, parallel Wordsworth's poetic theory. Although

the old standards remained quantitatively significant, the various elements we conventionally associate with Romanticism were in the ascendant. Consequently, Johnson and Pope were depreciated, the Pre-Romantics were given exaggerated appreciation, and popular poets built reputations by using Romantic material for content and form.

The final and crucial test of whether readers and critics were prepared for a poetry inimical to Neo-classical taste is the reception of *Lyrical Ballads*. There were ten notices of the volume (the standard biographers of Wordsworth and Coleridge refer directly only to three), and taken together they show a predominantly favorable reaction to what was considered an important publication. After a year of slow sales the volume rapidly sold out. By 1805 four editions of the original volume were published (there were five if we include an American reprint of the 1800 edition). Relatively few volumes of poetry ever reached a fourth edition. In short, *Lyrical Ballads* fared much better in its own time, both critically and popularly, than has generally been believed.

The distinction that *Lyrical Ballads* won was due to excellence, not to newness; the forces working to undermine the traditional values of the century were already dominating the scene. Had Wordsworth and Coleridge never written a line, Romanticism would have been indisputable monarch of literature early in the nineteenth century.

321 pages. \$4.01. MicA 55-1440

FOUR COMMUNITY SUBSCRIPTION
LIBRARIES IN COLONIAL PENNSYLVANIA:
DARBY, HATBORO, LANCASTER AND
NEWTOWN, 1743-1790

(Publication No. 12,159)

Ruth Willard Robinson, Ph.D.
University of Pennsylvania, 1952

Supervisor: Dr. Thomas P. Haviland

This study was inaugurated to trace the development of four community subscription libraries (library companies) in eighteenth-century Pennsylvania from the inception of the earliest, Darby Library Company, in 1743, until 1790; to locate, identify and classify the existing records in the attempt to understand how men of these neighboring Pennsylvania communities met and solved the problem of bringing books into their daily lives; to learn what type of organization they selected and whether it succeeded; and finally to study the books themselves and, in the expressed preferences of the library members, to infer the reading habits and opportunities which were forming an American reading public, prerequisite of an American literature.

A preliminary survey of the development of subscription libraries in eighteenth-century America, with which the study opens, discloses but two of these

libraries in existence at the time of the founding of Darby Library Company, while at the close of the period (1790) there were about thirty. The movement illustrates how colonists solved the problem of an environment which was in danger of losing touch with fundamental developments in British and European civilization, by providing themselves with libraries in which, as an apologist for Union Library Company of Hatboro observed, "the opulent friend to learning may be furnished with authors not generally found in private collections." The study examines the colonial background of the four communities in some detail, with a consideration of the men and conditions instrumental in the founding and continuation of the libraries, then proceeds to an examination of the records of the four library companies, comparing their approaches to the problems which they faced in common. Although the chronological order of development is

Darby Library Company	Founded 1743
Union Library Company, Hatboro	Founded 1755
Lancaster Library Company	Founded 1759
Newtown Library Company	Founded 1760

the three companies closest to Philadelphia, Darby, Hatboro, and Newtown, are studied together in that order, with the Lancaster Library Company last.

The library records offer a substantial testimony to the ability of colonial Pennsylvanians, in the second and third quarters of the eighteenth century, to work together in acceptance of the principles of equality and self-government. The library Articles of Association reveal considerable legal knowledge. Similarities in the organization of the libraries demonstrate a certain amount of influence from one to another, some of which can be documented. The three companies nearest Philadelphia - Darby, Hatboro, and Newtown - experienced a certain amount of financial difficulty following the period of initial enthusiasm, but successfully survived the Revolutionary War and reorganized for a fruitful development which has continued to the present. The library company in Lancaster barely survived its eighteenth-century beginnings.

Books were originally ordered from England, but by 1758 were being purchased in Philadelphia, chiefly from David Hall. A study of the accessions reveals the resources of Philadelphia booksellers of the period. An examination of the books owned by the four library companies (as listed in their catalogues) shows that the largest single reading interest of the members was in belles lettres, with history and biography second and religion or political science third. This finding modifies the accepted view that the reading of American colonists was primarily utilitarian, and suggests that the library companies established a reading public which was accustomed to the enjoyment of purely literary works. Such a reading public was one of the necessary conditions for establishment of a native American literature.

Appendices give the lists of members and officers of the four library companies and a catalogue of the books owned by each library during the period ending 1790.

291 pages. \$3.64. Mic 55-144

MATHEMATICS

COMPARISON OF EXPERIMENTS IN THE INFINITE CASE AND THE USE OF INVARIANCE IN ESTABLISHING SUFFICIENCY

(Publication No. 12,259)

Charles H. Boll, Ph.D.
Stanford University, 1955

In this paper an experiment is characterized by a measurable space along with a class of probability measures where the index set of this class is interpreted as the class of states of nature. The problem of comparing two experiments, each having the same class of states of nature, is extended from finite to arbitrary classes of states of nature.

Bohnenblust, Shapley, and Sherman (unpublished paper) introduce a comparison of two experiments based upon the set inclusion relation of their classes of risk functions. One experiment is said to be more informative than another experiment if for every action space and every loss function, a risk function attainable from the latter experiment is also attainable from the former experiment. This means that for any decision procedure based on the second experiment, there is a decision procedure based on the first experiment which has the same risk function. In general, two experiments will not be comparable, i.e., neither will be more informative than the other.

Blackwell ("Comparison of Experiments," Proceedings of the Second Berkeley Symposium on Mathematical Statistics and Probability, University of California Press, 1951, pp. 93-102), gives an alternative method of comparing two experiments. One experiment is sufficient for another experiment if an observation from the first experiment is essentially a sufficient statistic for an observation from the second experiment.

If one experiment is sufficient for another experiment, then the first experiment is always more informative than the second experiment for an arbitrary class of states of nature.

Blackwell ("Equivalent Comparisons of Experiments," Ann. Math. Stat., Vol. 24 (1953) pp. 265-272), has shown the converse relationship of more information and sufficiency only when the class of states of nature is finite. Under certain regularity conditions which are usually met in practice, the theorem of Blackwell is extended for the case when the class of states nature is arbitrary.

The principle of invariance is introduced to the problem of the comparison of experiments by the notion of an admissible group operating on the pair of experiments. If one experiment is sufficient for another experiment, then subject to certain regularity conditions, there is a sufficient statistic which is invariant under the admissible group. Thus if one is trying to compare one experiment with another, it is

sufficient to examine only the class of invariant sufficient statistics.

An example is given in which a pair of random variables, the first being normally distributed and the second being proportional to a chi-square variable, is compared with another pair of random variables, which is similar to the former pair except for a change of scale and a change in the number of degrees of freedom of the chi-square variable. The above theorem on invariance is used to find necessary and sufficient conditions for the first experiment to be more informative than the second experiment.

Another example is given in which two n-dimensional random variables are compared when the translation group is an admissible group operating on the experiments. A necessary and sufficient condition that one experiment is more informative than another experiment is that the characteristic function of the less informative experiment is the characteristic function of the more informative experiment times a characteristic function. 34 pages. \$1.00. MicA 55-1441

SEVERAL SIMPLE, UNSOLVABLE PROBLEMS OF GROUP THEORY RELATED TO THE WORD PROBLEM

(Publication No. 10,850)

William Werner Boone, Ph.D.
Princeton University, 1952

This thesis was carried out under the direction of Professor Church with Professor Lyndon as second reader. It is shown that the theory of finitely presented groups contains certain simple unsolvable problems.

Chapter I: the problem of determining whether or not an arbitrary element of a certain finitely presented group can be expressed in terms of a fixed subset of the symbols constituting the notation of the group is (recursively) unsolvable. Thus, given L , a (recursive) sequence of words of this group, it is recursively unsolvable to determine whether or not some word of L equals the identity.

An abstract of this work appears in The Journal of Symbolic Logic, vol. 16, no. 3, pp. 237-238. This unsolvable problem is similar to Magnus's extended word problem (Das Identitätsproblem für Gruppen mit einer definierenden Relation, Mathematische Annalen, vol. 106, no. 2, pp. 295-307).

Chapter II: the problem of determining whether or not a certain fixed symbol of the notation of a group can be eliminated from an arbitrary word of that group is (recursively) unsolvable.

An abstract of this work appears in The Bulletin of the American Mathematical Society, vol. 58, page 40. Cf.,

wherein a very similar problem is cited, Magnus, *Diskontinuierliche Gruppen mit einer definierenden Relation*, Crelles Journal, vol. 163, pp. 141-165.

Chapter III consists of a proof using the techniques developed in Chapter I (and somewhat simpler than Turing's proof, *The Word Problem in Semi-Groups with Cancellation*, *Annals of Mathematics*, vol. 52, no. 2, pp. 491-505) that the word problem for cancellation semi-groups is (recursively) unsolvable.

167 pages. \$2.09. MicA 55-1442

INVARIANT MEANS AND MEASURES ON SEMIGROUPS

(Publication No. 12,128)

Thelma Mae Chaney, Ph.D.
University of Washington, 1955

A semigroup G is a non-void set of elements closed under an associative multiplication. A non-void subset of G which is closed under multiplication on the right by elements of G is a right ideal in G .

Let G be a finite semigroup. Then there exists a right invariant mean on G if and only if G contains a right ideal which is a group; there exists a right invariant measure on G if and only if G contains a right ideal which is a group such that its complement is also a right ideal. The structure theorem for all invariant means and measures on finite semigroups is given. If there is more than one right invariant mean on G , then there are no left invariant means; if there is both a right and left invariant mean on G , then they are equal. If G contains a unique left zero, then there exists a unique right invariant mean on G . This mean is also a unique left invariant mean. There exists a unique invariant mean on every finite commutative semigroup. For every right invariant measure there exists a right invariant mean, but the converse does not hold for semigroups in general. There exists both a right and a left invariant measure on G if and only if G is a group. If G is of order > 1 and G contains a right zero, then there does not exist a right invariant measure on G ; if G is of order > 1 and contains a unique left zero, then there are no right invariant measures on G . If there is more than one right invariant measure, then there is no left invariant measure. If there exists a right invariant measure, then there are no left invariant means and vice versa.

Let G be a finite semigroup. Let $L_1(G)$ be the space of all linear functionals on $F_1(G)$, the linear space of all complex-valued functions on G . For $B \in L_1(G)$ and $f \in F_1(G)$ let $B[y](f(xy))$ denote the function of x obtained by applying the linear functional B to $f(xy)$ considered as a function of y for fixed x in G . Then $L_1(G)$ is an algebra under ordinary addition and multiplication defined by

$$A * B(f) = A[x](B[y](f(xy)))$$

for every $A, B \in L_1(G)$. A semicharacter of G is a function $\hat{x} \in F_1(G)$ such that $\hat{x}(x) \neq 0$ for some $x \in G$ and $\hat{x}(xy) = \hat{x}(x) \hat{x}(y)$ for all $x, y \in G$. If $L_1(G)$ is a semi-simple algebra and $\hat{x}_1, \dots, \hat{x}_j$ are semicharacters of G ,

$$\text{then } L_1(G) \cong \{A(\hat{x}_1)\}_{A \in L_1(G)} \oplus \dots \oplus \{A(\hat{x}_j)\}_{A \in L_1(G)} \oplus \dots \oplus M_{s_{j+1}} \oplus \dots \oplus M_{s_t}$$

where each M_{s_i} is a total matrix algebra of order s_i^2 . The functional $I \in L_1(G)$ corresponding to the element

$$(1, 0, \dots, 0) \in \{A(\hat{x}_1)\}_{A \in L_1(G)} \oplus \dots \oplus M_{s_t}$$

is a unique left invariant functional on $F_1(G)$ such that $I(1) = 1$. It is also right invariant.

Let G be an arbitrary semigroup. Let $H(G)$ be the set of all functions on G which are arbitrarily uniformly approximable by complex linear combinations of coefficients of finite dimensional unitary representations of G . Then there exists an invariant mean over $H(G)$. If G has a unit, then $H(G)$ is equivalent to the set of almost periodic functions of Maak defined on G .

If G is a commutative topological semigroup, an application of the Markoff-Kakutani fixed point theorem shows the existence of an invariant mean over the space of bounded continuous functions on G .

119 pages. \$1.49. MicA 55-1443

ACCESSIBILITY IN EUCLIDEAN N-SPACE WITH APPLICATION TO DIFFERENTIABILITY THEOREMS

(Publication No. 12,021)

Albert George Fadell, Ph.D.
The Ohio State University, 1954

Adviser: Tibor Rado

Given a point $p = (p^1, \dots, p^n)$ in a subset S of Euclidean n -space R^n , the accessible set $A[p, S]$ of p is defined to consist of all points (x^1, \dots, x^n) in S which satisfy the condition that the points $(x^1, \dots, x^{j-1}, p^j, \dots, p^n)$ be in S , $j = 2, \dots, n$. A detailed study is made of the measure-theoretic properties of the accessible set. The main result, termed the Accessibility Theorem, states that almost every point p of an L_n -measurable subset S of R^n is a point of density for its accessible set $A[p, S]$. For $n = 1$ the Accessibility Theorem follows from the Lebesgue Density Theorem and the identity $A[p, S] = S$ for p in S . But for $n \geq 2$ to prove the Accessibility Theorem, we first prove the following theorem. Given $2 \leq k \leq n$ and $p = (p^1, \dots, p^n)$, let $\pi_k p = (p^1, \dots, p^{k-1})$ and let $S(p^k, \dots, p^n)$ denote the set of points (x^1, \dots, x^{k-1}) for which the point $(x^1, \dots, x^{k-1}, p^k, \dots, p^n)$ is in S : then for $n \geq 2$, given an L_n -measurable subset S of R^n , a point $p = (p^1, \dots, p^n)$ is a point of density for $A[p, S]$ if (a) p is a point of density for S , (b) $S(p^k, \dots, p^n)$ is L_{k-1} -measurable for $k = 2, \dots, n$, and (c) $\pi_k p$ is a point of density for $S(p^k, \dots, p^n)$ for $k = 2, \dots, n$. Then

the Accessibility Theorem follows as a corollary by application of the Lebesgue Density Theorem, the Fubini Theorem, and the so-called Sectional Density Theorem (which we prove) which asserts that for almost every point $p = (p^1, \dots, p^n)$ the point $\pi_k p$ is a point of density for $S(p^k, \dots, p^n)$ for $k = 2, \dots, n$. A natural application of the Accessibility Theorem, together with the well-known Lipschitz-Extension Theorem, yields a proof of the n -dimensional analog of the well-known Rademacher-Stepanoff Theorem characterizing the existence almost everywhere of a Stolz total differential. By a second application of the Accessibility Theorem, together with the Rademacher-Stepanoff Theorem, a proof is given for the n -dimensional analog of the well-known Stepanoff Theorem characterizing the existence almost everywhere of an approximate total differential.

127 pages. \$1.59. MicA 55-1444

SOME THEOREMS ON THE BERNOULLIAN MULTIPLICATIVE PROCESS

(Publication No. 10,915)

Theodore Edward Harris, Ph.D.
Princeton University, 1947

Abstract not available.

64 pages. \$1.00. MicA 55-1445

AN n -DIMENSIONAL EUCLIDEAN ALGORITHM

(Publication No. 12,081)

Herbert Aaron Hauptman, Ph.D.
University of Maryland, 1955

Supervisor: Professor Richard A. Good

The ordinary (one-dimensional) Euclidean Algorithm is given a geometric interpretation in terms of lattices on a line. An n -dimensional algorithm is then described which is a natural generalization of the one-dimensional algorithm in that the simple geometric interpretation of the latter is retained. Since matrix terminology proves useful, interesting applications to the theory of matrices with integer elements are also found. For example, a new and simple proof concerning the existence of a greatest common left (or right) divisor of two square matrices is given. Again, necessary and sufficient conditions are readily found for the existence of solutions of the system of equations $A = XB$, $B = YA$, where A and B are given matrices (not necessarily square) and X and Y are unknown matrices, all with integer elements. If the system is solvable, it is shown how to find a solution X , Y . Finally, the concepts of the unimodular matrix and left (or right) associates are extended in a natural way to matrices which are not square.

It is known¹ that the ordinary Euclidean Algorithm

leads directly to a means for expanding an arbitrary irrational number ξ into a simple continued fraction. The simple continued fraction in turn yields the "best" rational approximations to the irrational number ξ . The application of these methods to the study of certain diophantine equations, in particular the Pell equation $x^2 - Dy^2 = 1$, where D is a positive integer which is not a square, is also well known.²

Restricting attention to the two-dimensional algorithm, one might expect that it should lead to a method for expanding an arbitrary pair of irrational numbers $(\frac{\xi}{\eta})$ into a simple continued fraction which would in turn yield the best rational approximations $(\frac{z/x}{y/x})$, with common denominator x , to the given irrational pair $(\frac{\xi}{\eta})$. However, an unexpected difficulty arises in that the Euclidean Algorithm leads to several simple continued fraction expansions for the pair $(\frac{\xi}{\eta})$. Furthermore, it does not appear easy to decide which of these expansions is the correct one in the sense that it yields the best approximations to the given pair $(\frac{\xi}{\eta})$. Nevertheless, although no proofs are offered, the expansions of some twenty pairs $(\frac{\xi}{\eta})$ into simple continued fractions are given, and these do yield good rational approximations $(\frac{z/x}{y/x})$ to the given pair $(\frac{\xi}{\eta})$. Furthermore, the relationship to a diophantine equation, similar to the Pell equation for one dimension, is shown. By means of many numerical examples we are thus led to conjecture that the diophantine equation $x^3 + Ay^3 + Bz^3 - 3A^{1/3}B^{1/3}xyz = 1$, where A and B are positive integers neither of which is a cube, but AB is a cube, has infinitely many solutions in positive integers x, y, z ; and all of these are obtainable by the method involving simple continued fractions.

68 pages. \$1.00. MicA 55-1446

1. See, for example, L. E. Dickson, Introduction to the Theory of Numbers, University of Chicago Press, Chicago: 1929, pp. 105-115.

2. Dickson, *loc. cit.*

MACHINE COMPUTABILITY IN GAME THEORY

(Publication No. 11,999)

Frank Louis Wolf, Ph.D.
University of Minnesota, 1955

An S -game is a collection of objects $\{A_0, A_1, A_2, \dots, A_n, f, K, h\}$ where (a) the A_i are disjoint sets and A_0 is a one element set; (b) f is a single valued function which maps A_i onto A_{i-1} for $i = 1, 2, \dots, n$; (c) K is a single valued function which maps A_n onto a finite set of real numbers; and (d) $h = 1$ or 2 .

There are two players P_1 and P_2 . P_1 moves first and then the moves alternate. The first move consists of a choice of an element a_1 in A_1 . For subsequent moves, if a_{i-1} in A_{i-1} has been chosen then the next move consists of a choice of an element a_i in A_i such that $f(a_i) = a_{i-1}$. When a_n in A_n has been chosen, P_2 pays P_1 the amount $K(a_n)$. We let B_i be the set of points where it is the move of P_i and let $M(a)$ be the set of possible choices at point a .

In the usual terminology an S-game is a (possibly) infinite zero-sum, two-person game in which there are no chance moves, the moves alternate between players, and the pay-off function takes on only finitely many values.

By a strategy for P_1 is meant a function x defined on B_1 such that if a is in A_i then $x(a)$ is in A_{i+1} and $f(x(a)) = a$. Similarly for a strategy for P_2 . If a_n is the point in A_n which is chosen when the players play by the strategies x and y , then we write $K(x,y) = K(a_n)$. Let X (Y) be the set of strategies available to P_1 (P_2).

(x_0, y_0) is a solution of the game and x_0 and y_0 are optimal strategies if $K(x, y_0) \leq K(x_0, y_0) \leq K(x_0, y)$ for all x in X and all y in Y . x_1 dominates x_0 if $K(x_1, y) \geq K(x_0, y)$ for all y in Y with the strong inequality holding for some y in Y . Similarly for strategies for P_2 . A strategy is called best if it is optimal and is dominated by no other strategy.

Theorem 1. In any S-game each player has a best strategy.

The proof is by induction on n and uses the ordinary (not strictly constructive) methods of analysis.

An S-game constructively defined if $M(a)$ is a recursive set for each point a and K is a general recursive function. A game is called machine solvable if each player has an optimal strategy which is a recursive function. It is called completely machine solvable if each player has a best strategy which is recursive. A set of S-games is called uniformly machine solvable if there is a mechanical procedure which serves uniformly to find the machines which solve any game in the set.

Theorem 2. There exists a denumerable class of constructively defined S-games which is not uniformly machine solvable.

Corollary. There is no effective constructive method which will serve uniformly to find optimal strategies for all constructively defined S-games.

Theorem 3. If the set of all subgames of G is uniformly machine solvable and the predicate $\exists t(v(t) = k_i)$ is effectively decidable for $i = 1, 2, \dots, m$; then G is machine solvable. Here $v(t)$ is the value of the t th subgame and k_1, k_2, \dots, k_m are the values taken on by K .

Theorem 4. There exists a constructively defined S-game which is machine solvable but not completely machine solvable.

The undecidability of elementary number theory is made use of in the proofs of Theorems 2 and 4.

An S-game is called finite if A_n is finite.

Theorem 5. The set of all finite S-games is uniformly machine solvable.

52 pages. \$1.00. MicA 55-1447

MUSIC

GROUP INSTRUCTION IN PIANO: AN INVESTIGATION OF THE RELATIVE EFFECTIVENESS OF GROUP AND INDIVIDUAL PIANO INSTRUCTION AT BEGINNING LEVEL

(Publication No. 12,109)

Rita Johnson Hutcherson, Ph.D.
State University of Iowa, 1955

Chairman: Professor John Simms

This study reviews the inception, growth, and current status of group piano instruction in the schools. Despite widespread acceptance and reported success in numerous schools, controversy persists concerning the value of class piano work and its place in the school music program. This study was conducted in an effort to supplement the meagre existing evidence comparing the relative effectiveness of group and individual piano instruction.

The trend toward keyboard experience for the whole classroom as a part of the regular music program in the elementary school is reported. Ten study units outlining this type of integrated music education, designed to build basic music concepts and to familiarize third grade children with elementary principles of notation, are included in the Appendix.

Two experimental projects involving matched groups of children and of college students at the beginning level of piano, furnish the data used in comparing resultant learnings, skills, and attitudes deriving from class versus private lessons. These three advantages claimed by advocates of piano class over individual lessons were examined: (1) economy of teacher's time and pupil's money; (2) greater performing confidence; and (3) more rhythm proficiency in piano sight-performance. The first two claims were examined as they applied to children of age seven to nine. The validity of all three claims was investigated as applied to college beginning pianists (non-music majors) on the single comparison factor of rhythm proficiency.

An experimental and a control group of children matched on apparent factors influencing ability to learn piano were given identical instruction, the only variable being the method, i.e., group versus individual lessons. After fourteen weeks of instruction members of both groups were evaluated as to (1) knowledge of music rudiments; (2) recognition of familiar melodies by sight; (3) quality of prepared piano performance; (4) ability to play unfamiliar piano music; and (5) attitudes toward practice and continued piano study. Averaged teacher-time expended on the group-taught pupil was half that spent on the

individually-taught pupil. The difference in test results and questionnaire findings lacked statistical significance, so it is concluded that economy of teacher-time was effected.

In a second experiment matched pairs of college students without previous piano training were identically taught except for the variable of group versus individual method. After fifteen weeks of instruction members of both groups made tape recordings of two tests (comprising 186 measures) designed to give a crude measure of rhythm proficiency in sight performance. A jury of three experienced piano teachers scored rhythm and time errors recorded. In every instance the group-taught member of the pair made fewer such errors than did the individually taught member. All evidence obtained in this investigation supports the claim that group instruction makes for greater rhythm proficiency in sight performance. Test results showed the difference in the mean errors made by the two groups to be statistically significant at the five per cent level, in favor of the group-taught pupils.

The quality of performing confidence could not be isolated for evaluation and comparison; it could be observed only in its connection with other factors making up skill in piano performance.

Since group instruction generally costs less in tuition fees than individual piano lessons, the following conclusions appear warranted by the data presented in this investigation: (1) economy of teacher's time and pupil's money can be effected through group piano instruction at the beginning level; and (2) group piano instruction is more effective than individual lessons in developing rhythm proficiency in the sight-performance of easy piano music by college students (non-music majors). On the basis of these findings class piano work merits inclusion in the school curriculum.

257 pages. \$3.21. Mic 55-145

THE PSALM MOTETS OF CLAUDE GOUDIMEL

(Publication No. 11,939)

Eleanor McChesney Lawry, Ph.D.
New York University, 1954

Adviser: Dr. Curt Sachs

Although the psalm settings of Claude Goudimel (c. 1505-1572) were indirectly the cause of his death as a victim of the St. Bartholomew massacre, they unquestionably assured his immortality. His two collections of single-stanza settings of the complete Psalter have been republished as recently as 1895-97 and 1935 respectively. But his sixty-eight settings in motet style, highly praised in epitaphs, have suffered undeserved neglect. Early prints of only thirty-two complete and eight incomplete motets are accessible at this writing, one of which was transcribed by Douen in 1878.

These motets contain from one to ten partes each, with divisions into three and two predominating. A basic scoring a 4 is varied by settings a 2 to a 8 for individual partes. From four to seven minutes represents the norm of performance time needed for a motet, the shortest requiring less than two minutes and the longest not quite twenty.

Since each of these works consists of a succession of different settings of the stanzas (up to twenty) of an entire psalm, the extent to which a psalm's one-stanza Genevan melody is drawn upon assumes considerable structural significance. A series of variations inevitably results in two motets having cantus firmus settings, and in nine more wherein the cantus predominates. Throughout these variations, the pace of the voice-part having the cantus is en rapport with that of the other members of the ensemble.

In fifteen motets which show a diminishing use of the cantus, and in fourteen others in which its use is negligible, melodic variation is often traceable among the free line-settings of a work; or an intricate mesh of motivic interrelationships serves to bind together its partes, as well as the stanzas within a pars. Sometimes both devices are used in the same motet. Melodic similarity, in varying degrees, is a unifying factor in almost all of these compositions.

Some of Goudimel's motets follow the Josquin tradition, with points of imitation separated by clear-cut cadences and contrasted with occasional chordal sections. Others flow along in an unchecked stream of polyphony which is truly "Gombertian."

From whom Goudimel learned the art of composition is not known, but eloquent testimony of his thorough knowledge of the intricacies of polyphonic technique is given throughout his available psalm motets. They present a panorama of standard devices: imitation at a variety of intervals, sometimes pairwise, sometimes extending to canon a 2, a 3, a 4, and even to double canon; inversion, retrograde and retrograde inversion; varied order and spacing of the entries of voice-parts; and subtle rhythmic fluctuations between binary and ternary groupings in individual voice-parts, which unite in an ensemble of intricate counter rhythms.

Various types of dissonance, always treated with circumspection are frequent. They include the suspension dissonance and its harsher counterpart in which the note creating the dissonance is repeated rather than sustained; the stressed as well as the unstressed passing dissonance; the cambiata and the é chappée; and the upper (a few) and lower auxiliaries. Augmented and diminished intervals occur without involving the bass.

A sprinkling of accidentals in these early prints serves as a reminder of the rules of musica ficta. Some are added causa pulchritudinis. The treatment of the text is often humanistic--at times, even madrigalistic.

These works, published over a period of fifteen years (1551-1556), may well represent the height of Goudimel's artistic maturity. They are of paramount significance in the history of the sixteenth-century motet.

234 pages. \$2.93. Mic 55-146

PHARMACOLOGY

THE ESTROGENIC ACTIVITY OF RESIDUES OBTAINED FROM CHICKENS TREATED WITH PELLETS OF DIETHYLSTILBESTROL

(Publication No. 11,650)

Philip Charles Merker, Ph.D.
Purdue University, 1955

Major Professor: Leroy D. Edwards

The object of this research was to demonstrate the presence or absence of residual estrogenic activity in the "edible" carcasses of chickens which had been treated with diethylstilbestrol. The methods for solving this problem centered about three techniques; extraction, biological testing and the inverse isotope dilution method of analysis.

Over a period of seven months a total of 48 six week old Barred Rock cockerels were treated with diethylstilbestrol in the form of a 15 mg. pellet containing 12 mg. of the estrogen. Groups of 3-4 of the treated as well as control chickens were sacrificed at the end of 7, 14, 21, 28 and 35 days of treatment. The "edible" carcasses were dressed, drawn and extracted for free and conjugated phenolic substances. The residues were tested for estrogenic activity using the "mouse uterine weight" as an index of activity. The biological tests revealed that there was no significant difference in estrogenic activity

between the residues of the diethylstilbestrol treated and the control chickens.

Paper chromatographic analysis of the free and conjugated phenolic residues of diethylstilbestrol treated and control chickens did not show any differences in their partitioning behavior. This method of analysis did not detect diethylstilbestrol in the residues isolated from the treated chickens.

An attempt was made to develop an inverse isotope dilution procedure for the analysis of submicrogram quantities of diethylstilbestrol using S^{35} labeled p-toluenesulfonyl chloride as the coupling reagent. The p-toluenesulfonyl ester of diethylstilbestrol was successfully synthesized. However, this method of analysis could not be applied to the residues because of the exceedingly low yields which were obtained when the reaction was conducted with less than submicrogram quantities of the synthetic estrogen.

As an auxiliary experiment of the thesis the endogenous respiration of homogenates prepared from livers taken from control as well as diethylstilbestrol treated Barred Rock cockerels was determined using the standard Warburg technique. The endogenous respiration of the treated livers was significantly greater than that of the control livers. The marked inhibitory effect of added diethylstilbestrol on the endogenous respiration of the homogenates was less with the treated than with the control livers.

87 pages. \$1.09. MicA 55-1448

PHILOSOPHY

AESTHETIC CLAIMS: A CRITICISM OF COLLINGWOOD'S, LEWIS'S, AND RICHARDS' THEORIES, AND AN ALTERNATIVE ANALYSIS OF CRITICAL EVALUATIONS

(Publication No. 11,907)

Herbert Kamins, Ph.D.
Cornell University, 1955

This study deals with the problem of whether a claim like "S is a good work of art" can ever significantly be denied, that is, can ever be logically incompatible with some other claim(s). If there is to be genuine disagreement and citation of evidence it must be possible for some claims to be logically incompatible with some other(s). A number of considerations are adduced to show how someone could come to adopt the subjectivist position that "concerning tastes there can be no disputing." Various arguments are offered to show that the several subjectivist translations of aesthetic claims are unacceptable.

Collingwood's, Lewis's, and Richards' translations of "S is a good work" are examined. These all exhibit the form "S is useful for the achievement of some purpose." It is argued that works of art are not used for the accomplishment of purposes (though they can be so used). It is further argued that if the purpose to be accomplished by the person contemplating a given work is "enjoyment" or some "emotional state," then it logically cannot be that the work can be used (or be useful) for the achievement of such states. An attempt is made to show how the translation of "good" as "useful for achieving enjoyment," etc., can seem plausible; from this attempt can be seen the mistakes committed by someone who holds such a theory.

Such translations are offered (partly) in an attempt to make aesthetic claims conform to the traditional account of logical contradictories, thus allowing for the possibility of dispute. An alternative analysis, based on the actual use of critical evaluations, is offered. This analysis proceeds by presenting the criteria that would necessarily have to be employed

in ascertaining whether someone understood how to claim merit of art works. By virtue of these criteria it can be seen that the claim "S is a good work" logically implies--though does not entail--that the claimant likes the work, would want others to come to like it, would urge it on and recommend it to others, would choose it himself, etc., and would have appropriate reasons for all this.

Though (on this analysis) the claim "S is a good work" and its denial would not conform to the traditional account of logical contradictories, it would be wrong to conclude that they cannot be logically incompatible. This conclusion follows only if contradictories are thought to exhaust the class of logically incompatible formulations. These claims can be incompatible as recommendations. The mistake of Lewis and others is to have thought that, in order to have disagreement about merit, aesthetic claims and their denials would have to be (or entail) logical contradictories. Argument and dispute is possible, even though from the truth of a given claim the necessary falsity of that claim's denial cannot be deduced.

295 pages. \$3.69. MicA 55-1449

THE CONCEPT OF DIALECTIC

(Publication No. 11,951)

Jessie Elizabeth Ritchie, Ph.D.
New York University, 1954

Adviser: Marie Collins Swabey

The term "dialectic" comes from the Greek word "dialogo" and derives from the same root as "dialogue," which is a discussion carried on alternately by two individuals. The discussion progresses by means of the statements and counter-statements of the participants, that is, through the opposition of their views. By dialectic is most often meant that which has the nature of a discussion or debate. When the term is used in reference to the process of reasoning, its method is to treat concepts as products of a process. Ideas develop and the truth is reached through the clash of opposite opinions. When the term is applied to reality itself, the dialectical conception is that all reality is in the process of development as a result of certain antagonisms that are inherent in its structure.

Obviously the term "dialectic" has received many interpretations throughout the history of philosophy. But the term has come to have as its positive content a notion of development through the union of opposites as a result of their interaction on each other. At the basis of the concept of dialectic is the idea that everything both acts and is acted upon. Everything is not only what it does, according to this concept, but what is done to it as well, for out of the constant interaction of opposite old forms pass away and new ones emerge.

In this dissertation it is our purpose to examine and criticize some of these contrasting concepts of

dialectic, including those of Socrates, Plato, Kant, Hegel, Kierkegaard, and Marx, which have appeared in the history of philosophy, and to consider the operation of dialectic in reason. It is our belief that there are two elements in reason, a formal and an emotional one. The formal element in reason is static and controlling. It is not without an emotional factor, however, for it exhibits a desire for security, clarity, and systematicness which amounts to a passion. Reason becomes impatient with the static narrowness of its formal aspect, its lack of flexibility and fluidity. New forms press for recognition and so the door swings open to admit wider vistas of reality. Thus the other element which is vital, emotional, and dynamic takes over and casts off formal logic in revolutions of thought and life.

Thus reason is dialectical, oscillating between its formal and emotional elements, both of which have rights that cannot be ignored in the quest for absolute knowledge. The formal element can provide us with knowledge that is certain but not of ultimate significance. The emotional element can give us fragments of knowledge of an ultimate sort, but lacking certainty and coherence. These two elements are in constant conflict, each trying to impose its standards on the other; consequently, a tension is set up within reason. Reason desires to overcome this tension which is rooted in its dialectical nature and to be at rest. But it is incapable of reconciling the opposition between its two elements. It must, therefore, look to a source outside of itself, a source capable of providing certain and final knowledge. This is revelation, which is given to reason and the content of which is not discoverable by reason. Dialectical reason is thus driven finally to the quest for revelation.

168 pages. \$2.10. MicA 55-1450

THE PROBLEM OF HUMAN INDIVIDUALITY WITH EMPHASIS ON THE PHILOSOPHY OF ALFRED NORTH WHITEHEAD

(Publication No. 12,069)

James Robert Simmons, Ph.D.
Columbia University, 1955

The object of this essay is to present some of the more important difficulties of the problem of defining human individuality. One endeavor is that of pointing out the uniqueness of man (as species) in contrast to all other existences, and the uniqueness of men (as individuals) in contrast to one another within the species. A further difficulty is the need to show the unity of the human species and the integrity of individuals within the species. The question is also raised as to whether unity and uniqueness are achievements rather than given.

After having presented some evidence that human individuality cannot be taken for granted (in the light of evolutionary and field theories), a brief discussion of theories held by Dr. Paul Tillich and Dr. Reinhold Niebuhr is presented. The evidence gathered from

these thinkers indicates that they use the problem of man as the solution to their theological problem.

A more detailed study of the philosophy of Alfred North Whitehead is made, in which the grounds are given for charging that Whitehead also uses the problem of man as the solution to his philosophical difficulties. He fails to give a satisfactory definition of the human; and the individual is treated either as infinite and unified or as finite and bifurcated. In order to get from the first description (infinitude and unity) to the second (finiteness and bifurcation) Whitehead must appeal to his idea of God; but that idea shows the same difficulties that were originally inherent in his notions of human nature.

The discussion of Whitehead traces his metaphysical scheme from its base (or from his idea of relativity) to his theory of feelings, feeler, subject, "satisfaction," "decision," "perishing," "superject," and the world as many. Within this metaphysical scheme, Whitehead's definition of man-as-novelty seems to avoid the question as to the novelty of man -- just as his notion of "transition" seems to evade the question of how the transition from "the one" to "the many" is made. For reasons such as these, it is argued that Whitehead repeats problems as solutions.

The first chapter on Whitehead presents his method of philosophizing, a method which reverses that of science. Science is alleged, by Whitehead, progressively to disregard the concrete, meaningful aspects and to issue in abstractions; but philosophy is alleged to be that discipline which returns the concreteness ignored by science. The second chapter on Whitehead shows his attempt to present the individual (or "actual entity") as unified, an attempt that ends by enclosing the world in the individual. The last chapter on Whitehead presents his method of extricating the "cosmic individual" from the world and the world from that individual. The appeal is to a *deus ex machina*. It is shown that (even if divine intervention is accepted) the result is that the individual (as finite) is bifurcated.

The chapter on George Herbert Mead tries to show that he gives us a matrix out of which it may be possible to develop a theory of human individuality. An attempt is made to apply Mead's views to education and morality; for this illumines the thesis that Mead gives us a theory in which individuality can be stated as an achievement.

The last chapter is a summing up of various ideas gathered from the inquiry; and the suggestion is advanced that any intelligible theory of value awaits a definition of being human. Such a definition would take man as he is, not as he "ought to be." The theory would have to accept many ideas from our basic sciences, and incorporate the awareness of the present human body as an integral part of being human. But, if we wish to show that much of human nature can be stated as an achievement, the theory must go beyond biological notions.

The dissertation is an attempt to keep alive the problem of man, to show that as yet we have no satisfactory definition of basic humanity. It is an attempt, further, to show that if this problem is ignored, then many of the traditional problems of philosophy are

also ignored. When this evasion of first principles is made, then philosophy is reduced to trivialities.

303 pages. \$3.79. MicA 55-1451

A STUDY IN THE CORRESPONDENCE OF PERCEPTIONS

(Publication No. 11,858)

Gerald Brent Standley, Ph.D.
University of Buffalo, 1955

This is a study of correspondence theory as it relates to perception.

Correspondence theories of the truth of statements which identify objects and of generalizations yielding predictions are first taken up. Statements which simply identify objects (e.g., This is a white piece of paper) involve a correspondence between the words used and the object. These correspond if the words are appropriate to the perceptions of the object. Statements yielding predictions (e.g., friction generates heat) are true if the body of implications so constituted match the real world. Such correspondence is verified by the predictions.

Underlying both of these is perception. Here correspondence is between the content of consciousness and the physical object. Justification is offered for this dualism, the oppositions of the neo-realists and of Ryle being taken up. The correspondence is defined casually, i.e., the perception is said to be true in so far as it originates in the object. This entails a physiological approach to epistemology, which is defended.

This correspondence is held to be knowable, so that critical perception affords certain knowledge of the external world. An exposition is provided showing in what respects this differs from the commonly received notion that no knowledge about the world must be assigned a status higher than probable. The oversights of this notion are discussed and critical perception is shown to be proof against its objections.

The grounds for perceptual certainty are two: (1) errors spring from a limited number of sources, and under some conditions of perception all those sources are eliminated; (2) the awareness characterizing the organism renders those conditions identifiable.

Critical perception is critical on two scores: (1) it requires an organism that is not asleep, or hypnotized, or fevered, etc., but alert; (2) it strips the perception of all interpretation unnecessary to perceiving. It is held that both of these criteria can be employed without transcending consciousness.

The defense of this knowledge as certain involves a discussion of various sources of illusions: dreams, hallucinations, excitement, misleading appearances, etc.

The position defended is justified on two grounds. First, it offers a more faithful description of perceiving than the commonly received notion that perception yields only probable knowledge. It is absurd to hold that sensation is too immediate even to warrant

the application of the categories true and false (cf. Russell's doctrine of acquaintance) and at the same time that the perception in which that sensation occurs is in principle always capable of being untrue. Secondly, the pronouncements of critical perception about the external world are not so easily refuted as may at first appear. The identification of the critically perceived with reality not only constitutes an empirical hypothesis difficult to discover in a fault, but may also be used as a conventional definition of objectivity without incurring charges of phenomenalism. Though for purposes of science, such a convention is less useful than the one which science uses (viz., that the objective must show effects upon other

objects), this consideration does reveal the conventional nature of the definition of objectivity to which epistemologists must resort to refute perceptual certainty.

The discussion of these topics is accompanied by considerations of the men whose doctrines are most pertinent. The study considers Lewis's inexhaustible consequences; the opposition to dualism offered by the neo-realists, Macintosh and Ryle; Russell's views on belief and on acquaintance; Ryle, Russell, Lewis, and Price, on error; the critical realists (Sellars in particular); and the phenomenological realist, Spiegelberg.

237 pages. \$2.96. MicA 55-1452

PHYSICS

PHYSICS, GENERAL

A COINCIDENCE SCINTILLATION SPECTROMETER AND ITS APPLICATION TO THE STUDY OF THE NUCLEAR DECAY SCHEME OF Ac^{228}

(Publication No. 11,852)

Harold C. Box, Ph.D.
University of Buffalo, 1955

A coincidence scintillation spectrometer has been constructed for the investigation of gamma-ray spectra. Energy and coincidence studies of gamma spectra can be made. The spectrometer utilizes scintillation detectors consisting of NaI crystals attached to end-window photomultiplier tubes. Experimental results, showing the effect on energy resolution of various detector assemblies and of the photomultiplier voltage distribution, are presented. Optimum resolution obtained with the NaI detectors is about 7%. Gamma radiations of well-established energies were used to calibrate the spectrometer. The calibration sources were certain of the natural radioisotopes as well as some artificially produced radioisotopes activated at the University of Buffalo and at the Oak Ridge National Laboratory, Oak Ridge, Tennessee. Gamma-ray energies and coincidence relationships are determined from photographic records of the gamma-ray spectrum. The design of the spectrometer is such that the normal and coincidence gamma-ray spectra can be compared directly. The resolving time of the coincidence spectrometer is 1.5 microseconds.

Ac^{228} , the third member of the natural radioactive family of thorium, has been investigated using the coincidence scintillation spectrometer. A radioactively pure source of Ac^{228} was prepared from a 13-year old sample of thorium nitrate. In agreement with previous investigation by means of beta spectrometers, evidence was found for the following gamma-ray energies: 0.098, 0.127, 0.336, 0.410, 0.458, 0.907, 0.965, and 1.587 Mev. Evidence was found for additional gamma rays at 0.220, 0.278, 0.155, and 0.790

Mev, none of which has been reported previously. A number of coincidence relationships among these radiations has also been established. The coincidence results lead to the conclusion that the decay scheme previously proposed for Ac^{228} is untenable. A new decay scheme consistent with the foregoing coincidence and energy results is proposed.

96 pages. \$1.20. MicA 55-1453

THE FAR INFRARED SPECTRA OF SEVERAL PYRAMIDAL TRIHALIDES

(Publication No. 12,017)

Philip Wadle Davis, Ph.D.
The Ohio State University, 1954

Adviser: R. A. Oetjen

Several improvements were incorporated into the far infrared spectrograph of The Ohio State University. The Golay radiation detector mounting was so arranged as to remove the detector from the instrument vacuum and allow it to be in the atmosphere the same time the path length of the infrared radiation through the air was kept under 1 cm. This, together with several other minor changes in the instrumentation, has resulted in better reproducibility of data.

A second grating was installed and calibrated. This extends the range of the instrument and useful data can now be obtained at wave lengths as short as 17 microns.

The spectra of five trihalides of elements in the nitrogen column of the periodic table were investigated. These substances are PCl_3 , SbCl_3 , PBr_3 , and SbBr_3 . Group theory predicts that pyramidally shaped molecules XY_3 will have four fundamental normal modes of vibration, all of them being both infrared and Raman active. Previous Raman measurements of these substances indicated that the vibrations were all of low frequency to fall between 80 and 500 cm^{-1} , a

spectral range which can be investigated using the spectrometer in its present condition.

Since PCl_3 , PBr_3 , and AsCl_3 are liquids at room temperature, it was necessary to design a liquid cell for use with the spectrometer. This cell has wire-reinforced polyethylene windows with a spacer of Koroseal. For the PCl_3 and the PBr_3 a sample thickness of 1.2 mm was used, while for the AsCl_3 the thickness was about 0.5 mm. Each of the four vibrational fundamental frequencies was identified and measured for the two liquid chlorides. In the case of the PBr_3 only three absorptions were observed, and the assumption was made that the weaker σ_1 parallel frequency (Herzberg's notation) was hidden by the strong perpendicular frequency. Bond angles were taken from the best data available, either microwave or electron diffraction, and force constants were calculated using a four-constant potential function devised by Howard and Wilson.

For the two solids, SbCl_3 and SbBr_3 , a different technique was employed for obtaining the spectra. They were first purified by dissolution in CS_2 and subsequent recovery by evaporation. The pure crystals were then added to molten paraffin (approximately 120°C) where they melted and went into solution. The paraffin-plus-sample mixture was then poured onto a confined mercury surface until it was about a millimeter thick. After being cooled, the paraffin sheet could be placed directly in front of the spectrometer entrance slit and the spectrum obtained.

The four fundamentals of SbCl_3 were identified, although the σ_3 absorption has a curious appearance. On the high frequency side, the drop in intensity is sharp, while on the low frequency side of the line a gradually increasing absorption occurs throughout a 30 cm^{-1} spectral interval. In the case of the SbBr_3 , this effect was even more pronounced, the σ_3 absorption consisting of a flat-bottomed absorption band 30 cm^{-1} wide. Also, since no trace of the σ_1 absorption could be found, it was presumably being hidden by the broad absorption.

Attempts were made at explaining these phenomena by calculating the effects of the isotopic molecules to be expected, but these attempts were not successful except in the case of SbCl_3 , where a supplementary absorption near σ_3 seems to be satisfactorily accounted for.

88 pages. \$1.10. MicA 55-1454

THE DETERMINATION OF THE STRUCTURE OF LIQUID HELIUM BY X-RAY SCATTERING

(Publication No. 12,028)

William Livingston Gordon, Ph.D.
The Ohio State University, 1954

Adviser: Charles H. Shaw

One question of importance in the study of the lambda phenomenon in liquid helium (mass 4) is that of the change in atomic arrangement in the liquid for

temperatures above and below this transition temperature. X-ray scattering offers one method for determination of this arrangement through the interpretation of interference effects which can be attributed to interatomic spacings. In the method reported here, intensity as a function of scattering angle for copper $K\alpha$ x-rays was determined at 4.2°K and 1.4°K , above and below the lambda transition at 2.19°K . Proportional counter registration of the scattered x-ray intensity was used together with a Ross differential x-ray filter and a differential pulse height analyzer for monochromatization and for spurious background reduction. Scattering angles from 1.5° to 90° were covered. The helium sample was contained in a thin-walled beryllium tube, one-quarter inch in diameter, in good thermal contact with, but separate from, a temperature-regulating helium bath. The sample temperature was determined from its vapor pressure.

The collimating and observation slit systems both permitted a maximum horizontal cross fire of $1/3$ degree. The vertical divergence for each slit system for scattering angles greater than 5° was about 7° and was decreased to about 2° for smaller angles. The scattering curves at 1.4°K and 4.2°K were repeated many times, with a final estimated observational error in the curves of approximately ± 0.7 percent near the peak, ± 1 percent at 10° increasing to ± 4 percent at 1.5° and ± 1.5 percent at large angles. A small amount of data were taken at 2.2°K .

Corrections for polarization, absorption in the helium and for change of scattering volume with angle are applied to the observed data. These corrected intensities are reduced to the liquid structure factor, $I(\theta, \lambda, T)$ by a combined use of the theoretical differential scattering cross sections for the isolated helium atom and a comparison with the scattering from gaseous argon. It was necessary to reduce the incoherent cross section of helium by 8 per cent in order to make L approach unity in the region of $90^\circ (= 2\theta)$. The liquid structure factor is extrapolated to $L(0^\circ, T)$ where its value is given as a function of temperature and isothermal compressibility of the liquid. Such an extrapolation permits the completion of the L curve at small angles and gives the approximate size of any clustering which might occur in the liquid.

The theory for interpretation of these scattering patterns to yield a radial distribution function for the liquid is described as are the factors which contribute errors to this analysis. Radial distributions at 1.4°K and 4.2°K are obtained, and identification of spurious peaks made. These results are compared with those obtained previously by Reekie¹ at 2.08°K . The relation of this information to the theory of liquid helium is discussed. 212 pages. \$2.65. MicA 55-1455

1. Reekie, J., and Hutchison, T. S. "The Structure of Liquid Helium." *Phys. Rev.* 92 (Nov., 1953), p. 827.

THE OPTICAL CONSTANTS OF THIN FILMS OF CADMIUM SULPHIDE

(Publication No. 11,927)

Joan Gottesman, Ph.D.
New York University, 1954

Adviser: W. F. C. Ferguson

Dispersion and absorption in thin evaporated films of cadmium sulphide have been determined from reflection measurements made in vacuo. The spectral region between 4000 Å and 7500 Å was investigated.

Each film was deposited on part of an optically flat black glass plate of known refractive index. Reflectivity was measured by comparing the intensity of a parallel beam of light after normal reflection from the film with the intensity of the same beam after normal reflection from the uncoated glass. The reflection curve so obtained and a thickness measurement made by means of multiple beam interferometry constituted the data for each film. The thicknesses varied between 1200 Å and 6000 Å.

Cadmium sulphide in bulk form has an absorption edge at 5200 Å and has practically constant and negligible absorption for longer wavelengths. In the region of constant absorption, the data for a single film are sufficient to determine the complex index of refraction. For wavelengths within the absorption band, it was necessary to seek values of the complex refractive index which satisfied the data for two or more films.

A study was made of the effects of thickness and deposition rate on the optical properties of the films. For this purpose, it was necessary to use the region of constant absorption, since the results for each film could be obtained independently. Although no thickness dependence was found for either the index of refraction or the extinction coefficient, there was a measurable dependence of the index of refraction on the rate of deposition. The refractive index increased by about four per cent when the deposition rate was increased by a factor of six. The highest rate of deposition (900 Å per min.) resulted in films whose refractive index, 2.42 at 5890 Å, was lower than the bulk value of 2.52 by four per cent. Density measurements indicated that the porosity of the films - the generally accepted reason for the reduction of index - decreased as the deposition rate was increased.

The value of the extinction coefficient, corrected for scattering, rose within the absorption band from .04 at 5000 Å to 0.33 at 4100 Å.

The wavelength at which the maximum of the dispersion curve occurs was established as 4800 Å.

The effect of exposure to air and subsequent aging of the films was investigated. The results indicated a progressive contamination of the surface - probably oxidation - which could not be reversed by replacing the film in a vacuum environment.

65 pages. \$1.00. MicA 55-1456

EFFECT OF RING FORMATION ON OPTICAL ROTATORY POWER

(Publication No. 11,934)

Charles Luther Hamermesh, Ph.D.
New York University, 1954

Adviser: Kurt Mislow

(1) A series of compounds of the type,



where R and R' are methyl, ethyl, propyl or butyl have been prepared in the optically active state. Maximum rotations have been calculated on the basis of the comparison of the rotations of the corresponding alkyl phenylcarbinols derived from the ketones by non-racemizing transformations with the maximum rotations reported for these carbinols. Rotations have been reported at two wavelengths (546.1 and 589.3 mμ), in two solutions (toluene and cyclohexane), and, for 4-phenyl-3-hexanone and 3-phenyl-2-heptanone, at two temperatures (29° and 60°).

In the course of the synthesis of these ketones, a method has been developed for cleaving derivatives of labile optically active ketones which involves little or no racemization of the resulting ketones.

The controversy regarding the maximum optical rotation of phenylpropyl carbinol has been settled.

(2) 2-Phenylcyclopentanone has been resolved via its tartramazone. Rotational constants have been reported as in (1). The specific rotation of this ketone, e.g. $[\alpha]_{546.1}^{20} 5280^\circ$ (toluene) is the highest such value ever reported for a non-metallic organic compound.

(3) The rotation of 2-phenylcyclopentanone is about five times as large as that of any open chain analog. It has, therefore, been conclusively demonstrated that ring formation results in an enhancement of optical rotation. An interpretation, based on relative conformational freedom, is offered.

90 pages. \$1.13. MicA 55-1457

THE EFFECT OF ISOTOPIC SUBSTITUTION ON THE VIBRATIONAL WAVE FUNCTIONS AND THE DISSOCIATION PROBABILITY OF DIATOMIC AND LINEAR TRIATOMIC MOLECULES

(Publication No. 11,855)

Joseph G. Logan, Jr., Ph.D.
University of Buffalo, 1955

This thesis undertakes to explore in detail the effect of isotopic substitution on the vibrational wave functions of diatomic and linear triatomic molecules; to determine theoretically the effect of isotopic substitution on the probability of dissociation induced as a result of electron bombardment, and to indicate possible methods of modifying the potential curves of diatomic molecules in order to obtain better agreement with the potential energy curves deduced from previous experimental studies of the dissociation phenomena.

Convenient schemes for the evaluation of needed overlap integrals have been developed and applied to a study of the dissociation probability for molecular hydrogen, for transitions between the vibrational states $^1\Sigma_g^+$ and $^2\Sigma_g^+$. The pertinent vibrational wave functions were obtained using the Fues interaction energy between atomic centers fitted as closely as possible to the Morse potential functions. The distribution in kinetic energy of the low velocity ions produced from the state $^2\Sigma_g^+$ is determined and it is shown that the dissociation probabilities possess a "fine structure" as a function of excitation energy, i.e., are not a monotonic function of this energy. The value of the relative number of dissociated particles calculated using the Morse potential curve is shown to be smaller than that observed experimentally, due primarily to the failure of the Morse curve to accurately represent the behavior of the repulsive portion of the potential energy curve. The calculation of Stevenson, who assumed that the most probable inter-nuclear separation in the upper vibrational level can be assumed to be in the vicinity of the classical turning point, the delta-function approximation, is shown to be only approximately justified since the effect of uncertainty of nuclear separation in the upper state can lead to appreciable error in the determination of the actual number of particles dissociating.

A small isotope effect is observed on the vibrational wave functions of the upper state. This effect is such that for the heavier isotope the number of dissociating ions calculated from the quantum mechanical transition probability deviates less from the value calculated using the classical turning point of the upper state.

The available information with regard to the molecular parameters for the ionized oxygen, nitrogen, and carbon-monoxide molecules is reviewed and it is shown that the appearance of dissociated ions from the states $A^2\Pi$ and $C^2\Sigma^+$ for nitrogen; $A^2\Pi_u$, $A^4\Pi_u$ and $B^4\Sigma_g^-$ for oxygen; $A^2\Pi$ and $B^2\Sigma$ for carbon-monoxide cannot be accounted for using the conventional Morse potential curves. Approximate anharmonicity constants are suggested for these states which enable a better representation of the potential energy curves in the vicinity of small inter-nuclear distances. The value of these proposed constants differs in some cases from those deduced from spectroscopic data by a factor of 2. In addition, the known lowest ionized levels of these molecules are correlated with the latest mass spectrographic data enabling a more accurate determination of the dissociation energies for these states.

The effect of isotopic substitution upon the vibrational transition probability for a linear triatomic molecule in a approximation using a potential surface such that the wave equation may be separated, is investigated. It is shown that for molecules of the form, a-b-a and a-b'-a, where the prime denotes the heavier isotope, the mass effect is such that a slightly greater dissociation probability can be obtained for the heavier isotope. This effect is in direct contrast to that observed for diatomic molecules and may consequently permit an explanation of the observed bond-breaking probability for carbon-dioxide and other

linear molecules. The effect of mass on the bond-breaking probability of linear molecules of the form a-b-a and a-b-a' is also examined.

170 pages. \$2.13. MicA 55-1458

THE NEAR INFRARED SPECTRUM OF NITRIC OXIDE

(Publication No. 12,144)

Nathan Lankford Nichols, Ph.D.
Michigan State University, 1953

A study has been made of the overtone rotation-vibration absorption bands of nitric oxide occurring in the near infrared. Complete rotational analysis was possible for the 2-0 and 3-0 bands but not for the 4-0 band as the envelope only was obtained. The infrared data confirms the data from the electronic transitions involving the ground state.

An absorption cell containing a multiple traverse mirror system of the J. U. White type was constructed with the mirrors separated 35 centimeters. The absorption cell was used in conjunction with a vacuum infrared spectrograph built by R. H. Noble which consisted essentially of a rock-salt fore-prism monochromator and a plane grating to provide the dispersion for the lead sulfide photoconducting detector.

The 2-0 and 3-0 bands were obtained with absorbing paths of about four meter-atmospheres. The 4-0 band required an absorbing path of about 60 meter-atmospheres. The ground state of NO is a doublet Π state and each branch of a band consists of two components. It was possible to resolve the P components for both overtone bands, but not all the R components.

Careful reduction of the data gave values for the rotational constants as: $B_0 = 1.6965 \text{ cm}^{-1}$; $B_2 = 1.6631 \text{ cm}^{-1}$; and $B_3 = 1.6408 \text{ cm}^{-1}$. The equilibrium rotational constant B_e was determined as 1.7060 cm^{-1} which gave the equilibrium moment of inertia I_e as $16.404 \times 10^{-40} \text{ gm-cm}^2$ and the equilibrium separation of the atoms as $1.1503 \times 10^{-8} \text{ cm}$. The band origins were determined as 3724.16 cm^{-1} and 3723.48 cm^{-1} for the two components of the 2-0 band, and as 5544.28 cm^{-1} and 5543.69 cm^{-1} for the two components of the 3-0 band.

There were no evidences of any extreme perturbations to the rotational structure of the NO molecule nor was there any evidence of a transition from one coupling scheme to another. It is felt that the molecular constants presented here are more representative of the molecule than those previously determined from the electronic data and from the infrared fundamental band. 98 pages. \$1.23. MicA 55-1459

INFLUENCE OF ELECTRIC FIELDS ON ZINC SULFIDE PHOSPHORS

(Publication No. 12,087)

Sol Nudelman, Ph.D.
University of Maryland, 1955

Supervisor: Professor R. K. Wangsness

A variety of ZnS phosphor powders (electroluminescent and non-electroluminescent, fluxed and non-fluxed, hexagonal and cubic) were subjected to electric fields. The influence of the electric fields on the luminescence of the phosphors was investigated by using square, sinusoidal, exponential, and saw-tooth wave shapes, and pulses of variable duration, for frequencies ranging from 60-100,000 cps and for signal voltages up to 600 V(rms). Since substantial differences were found to exist in the brightness waves and time-average light output for the blue and green spectral regions, the investigations were carried out separately in each of these two regions.

All the phosphors, when continuously excited by ultraviolet radiation, had momentary stimulations at both the instants of field application and field removal; quenching occurred during the time that the field was on. The "field on" stimulation decreases with frequency up to about 20 kcps, and then remains constant or increases slowly. The "quenching" and the "field off" stimulation generally increase with frequency.

Electroluminescent phosphors excited by non-sinusoidal electric fields, produce brightness waves containing distinctive primary and secondary peaks. These peaks, when correlated with the wave shape of the applied field, offer direct evidence of the influence of polarization charges and, in addition, indicate the nature of the electronic transitions responsible for the observed luminescence. From the electroluminescence decay characteristics and the behavior of the peaks in brightness waves excited by electric pulses of variable duration, the polarization charge "build up" time can be determined. A ZnS (Cu, Pb) Sylvania green phosphor investigated in this manner was found to have electronic transitions involving centers, traps, and the conduction band for green luminescence, and only centers and excited levels of the same centers for blue luminescence. At 200 cps, the excitation process was found to be more efficient for the green than for the blue, and the polarization charge "build up" time was approximately 700 μ sec. Measurements of the time-average light output excited by sinusoidal fields from (60-20,000) cps indicate that present theory is inadequate to account for the electroluminescence observed at both extremes of the frequency range. Finally, the transition from quenching ripple patterns to electroluminescence brightness waves, observed for a phosphor continuously excited by ultraviolet radiation, indicates that the two phenomena are independent of one another.

114 pages. \$1.43. MicA 55-1460

THE MAGNETIC ANISOTROPY OF COBALT FERRITE AND NICKEL FERRITE

(Publication No. 12,090)

Henry Shenker, Ph.D.
University of Maryland, 1955

Supervisor: Professor Roald K. Wangsness

The purpose of this work was the study of the magnetic anisotropy energy of cobalt ferrite and nickel ferrite over the temperature range from 20°K to their Curie temperatures (approximately 800° and 860°K respectively). A short description is given of the theories of ferromagnetism and ferromagnetic anisotropy in cubic crystals. A classical theory, based on the work of Akulov, of the variation of the first magnetic anisotropy constant with temperature is presented. This is used as a basis for the theoretical justification of the empirical Brückhatov-Kirensky relation,

$$K_1(T)/K_1(0) = e^{-\alpha T^2},$$

for the temperature variation of the first magnetic anisotropy constant of ferromagnetic materials.

The various methods of measuring the magnetic anisotropy energy are reviewed. In connection with the torque method, a rapid way was devised of evaluating the magnetic anisotropy constants from the torque curves.

For use with cubic materials having a high magnetic anisotropy energy, a method of measuring the first magnetic anisotropy constant was devised which utilized measurements of the torque only for directions of magnetization near the direction of easy magnetization. This method requires smaller fields than other methods and also yields the value of the saturation magnetization.

The difference between the magnetic anisotropy energy as usually measured for the crystal under conditions of constant stress and that which would be measured for the crystal under conditions of constant crystal dimensions is considered and found to be of the order of 10% for nickel ferrite; the available data permit no estimate to be made of the magnitude of this difference for cobalt ferrite.

A description is given of the apparatus which was designed to measure the magnetic anisotropy energy of crystals by torque methods over a wide range of magnetic anisotropy values and over a temperature range of 20° to 900°K.

The first magnetic anisotropy constant of a cobalt ferrite crystal, of composition $\text{Co}_{1.01}\text{Fe}_{2.00}\text{O}_{3.62}$ was determined to be closely approximated by the equation

$$K_1 = 19.6 \times 10^6 \times 10^{-8.27} \times 10^{-6} T^2 \text{ ergs/cc}$$

from 20°K up to 325°K. Above 325°K the measured anisotropy changed with the time the crystal was in the magnetic field.

The magnetic anisotropy constants of a nickel ferrite crystal, of composition $\text{Ni}_{0.68}\text{Co}_{0.078}\text{Fe}_{2.00}\text{O}_{5.76}$ (where the amount of oxygen is doubtful) was

determined over a temperature range from 20° to 825°K. K_1 is closely approximated by the equation

$$K_1 = (8.08 \times 10^{-1.55 \times 10^{-5} T^2} - 9.78 \times 10^{-0.375 \times 10^{-5} T^2}) \times 10^4 \text{ ergs/cc}$$

up to a temperature of 600°K. K_2 was determined to increase from -4.7×10^4 ergs/cc at 20.5°K, to zero at 190°, to a maximum of $+1 \times 10^4$ at 280°, and to decrease rapidly to zero above this temperature.

It was found that when these crystals were heat-treated by cooling in a magnetic field from above the Curie temperature that the magnetic anisotropy of the cobalt ferrite crystal changed markedly and that the average change for the nickel ferrite crystal was of the order of 15%. 71 pages. \$1.00. MicA 55-1461

of this far field factor which, according to theory, is proportional to the scattering cross section coefficient.

For a tandem slit separation of zero, corresponding to a single slit, the scattering cross section coefficients as computed from the stationary form with the currents on the edges assumed to be zero (Kirchhoff-type approximation), as computed from the exact theory of Morse and Rubenstein, and as determined experimentally are all in good agreement for slit widths greater than 0.3λ .

A calculation was carried out using the Kirchhoff-type approximation in the stationary form of the scattering cross section coefficient for a tandem slit separation of 0.157λ . The results are in good agreement with the experimental values for slit widths greater than 0.5λ . The experimental results show an interesting resonance effect as the slit width changes.

112 pages. \$1.40. MicA 55-1462

PHYSICS, ELECTRONICS AND ELECTRICITY

MICROWAVE TANDEM SLIT DIFFRACTION

(Publication No. 12,075)

Leroy Romney Alldredge, Ph.D.
University of Maryland, 1955

Supervisor: Professor R. K. Wangsness

The diffraction of a plane electromagnetic wave by two identical slits in tandem is investigated both theoretically and experimentally for normal incidence with the polarization parallel to the edges of the slits.

The slits are assumed to be infinitely long thus reducing the problem to one in only two dimensions. As an aid to an understanding of the tandem slit case the single slit is first considered; for this case, simple theoretical expressions are obtained for the transmission coefficient and the scattering cross section coefficient. The stationary forms of these same quantities are next derived in terms of the electric field in the slit.

The theory for the tandem slits shows that the scattering cross section coefficient is related in a simple way to the far field forward scattered amplitude. The stationary form of the scattering cross section is developed in terms of the unknown currents on the edges of the conductors forming the slits. This expression is very complicated and its stationary properties are not employed in this paper to obtain an approximation to the scattering cross section coefficient.

The infinitely long slits are approximated experimentally by use of a parallel plate system described earlier by Row. Measurements were made for tandem separations of the slits from 0 to nearly 2λ and for slit widths from 0 to 1.4λ . The field intensity and phase were measured at a point far behind the slits on a line through the slits and perpendicular to the planes forming the slits. It is the imaginary part

PHOTOCONDUCTIVITY AND RECOMBINATION PROCESSES IN CADMIUM SULPHIDE

(Publication No. 11,887)

John Joseph Lambe, Ph.D.
University of Maryland, 1954

Supervisor: Dr. Jules de Launay

An experimental investigation has been carried out on photoconductivity and luminescence in crystals of CdS. The primary goal has been to clarify the nature of the recombination processes and the manner in which they affect the photoconductivity. The three aspects of the recombination process which have been studied in the present work are the dependence of this process upon temperature, the dependence upon wavelength of exciting light, and the role of luminescence.

In making measurements of photoconductivity an alternating current method has been employed. The a.c. frequencies used range from 1 KC to 1 MC. By means of this technique, some of the difficulties of the direct current methods have been avoided, and also by utilizing capacitive coupling, the need for a metallic contact directly onto the CdS crystal has been eliminated. The measurements on photoconductivity and luminescence consisted of steady state measurements under various conditions and also measurements of their transient behavior under pulsed light. From these measurements, information regarding the recombination processes has been obtained.

The study of the wavelength dependence of the photoconductivity and the recombination rate indicates that the recombination of holes and electrons is more rapid for excitation by light on the short wavelength side of the absorption edge. Using this information it is possible to explain the observed spectral response of CdS.

The temperature dependence of the recombination rate can be explained in terms of a strongly temperature dependent non-radiative process in addition to the radiative (luminescent) process. The temperature

dependence of the time constant of photoconductivity indicated that electron trapping may play an important role in determining the observed time constant at low temperatures. Thus the temperature dependence of the observed time constant cannot be directly related to the temperature dependence of lifetime of the conduction electron.

Simultaneous measurements of the time constants of photoconductivity and luminescence showed that in all cases the luminescence decayed more rapidly than the photocurrent. These measurements were made on red luminescence at room temperature, on green luminescence at 77°K, and on the orange luminescence of silver activated CdS between 77°K and room temperature. A fairly straightforward explanation of this behavior is presented on the basis that the luminescence arises from the trapping of free holes. In this manner the photocurrent and luminescence can be related in a way which is consistent with the experimental evidence presented.

125 pages. \$1.56. MicA 55-1463

PHYSICS, METEOROLOGY

NEAR-INFRARED TRANSMISSION THROUGH SYNTHETIC ATMOSPHERES

(Publication No. 12,036)

John Nelson Howard, Ph.D.
The Ohio State University, 1954

Adviser: Dudley Williams

The total absorption of an absorption band is the area under the curve obtained when the fractional absorption at a given frequency is plotted against frequency. This quantity is convenient to use because it can be shown that the total absorption is independent of the width of the slits or other characteristics of the spectrometer and depends only on the physical properties of the absorbing medium.

This report presents a laboratory study of the total absorption of the near-infrared absorption bands of H₂O and CO₂ under simulated atmospheric conditions. This study utilized a 22-meter, multiple-traversal absorption cell, in which the geometrical path length of the cell and the partial pressure of the absorbing gas could be separately varied, and varying pressures of nitrogen and oxygen, which do not absorb appreciably in the near-infrared, could be added to the absorption cell. Temperature was not varied in this study. The CO₂ absorption bands at 15, 5.2, 4.8, 4.3, 2.7, 2.0, 1.6 and 1.4 microns were studied individually for absorber concentrations ranging from 1 to at least 1000 atmo-cm CO₂ for CO₂ partial pressures up to 50 mm Hg and for various total pressures with nitrogen up to 740 mm Hg. Similar studies were made for the H₂O absorption bands at 6.3, 3.2, 2.7, 1.87, 1.38, 1.1 and 0.94 microns for absorber concentrations ranging from 0.001 to 3.8 precipitable cm H₂O. Low resolution spectra of these bands are

presented, as are tables of the measured total absorptions for the various values of absorber concentration, w, absorber partial pressure, p, and total pressure, P.

Two types of relations appear to fit the experimental data satisfactorily. When the absorption band is weak the total absorption, $\int A_\nu d\nu$, is given by

$$\int A_\nu d\nu = c w^{1/2} (P + p)^k,$$

where k is about 0.4 for CO₂ and 0.3 for H₂O. For stronger bands, that is, for total absorptions above a certain value, the total absorption is predicted quite well by a relation of the form

$$\int A_\nu d\nu = C + D \log w + K \log (P + p).$$

The coefficients c, k, C, D, and K do not have direct physical significance, but are experimentally determined for each band.

The addition of the partial pressure of the absorbing gas, p, to the total pressure, P (which already contains the partial pressure once), gives a double weight to the effect of the absorber partial pressure, and is an approximate correction for effects due to collisions between like absorbing molecules.

An example is presented to show that the CO₂ absorption bands, which have a fairly regular structure, can be approximated by means of the so-called Elsasser model of an absorption band, which is a highly idealized band consisting of equidistant absorption lines of equal intensity, each having the same Lorentz shape.

The H₂O absorption bands have a highly irregular distribution of line intensities and line spacings. An absorption band of this kind can be approximated by the so-called Goody model of an absorption band. In the Goody model, the line spacings in a given frequency interval are assumed to have a random distribution, and the same assumption is made for the line intensities. The H₂O absorption data of this experimental study was used to determine the parameters of the Goody model, and this band model was then used to predict the H₂O band absorption for 3, 10, and 50 precipitable centimeters of water vapor.

248 pages. \$3.10. MicA 55-1465

THE ATMOSPHERIC LUNAR TIDES

(Publication No. 11,954)

Ryukichi Sawada, Ph.D.
New York University, 1954

Adviser: Bernhard Haurwitz

The atmospheric lunar tides are discussed theoretically following Hough's and Pekeris-Wilkes' methods for various temperature profiles including the Pekeris profile.

The effects of the temperatures of both the ionosphere and the ozonosphere on the surface pressure oscillation are discussed by deforming a temperature profile which approximates closely the recent rocket observations.

One of the results shows that the maximum pressure occurs 30 min. after the lunar transit when the ozonosphere has a temperature of 325°K , while the maximum occurs 2 hrs after the lunar transit when the ozonosphere has a temperature of 307°K . The ionospheric temperature modifies both amplitude and phase angle slightly but not negligibly.

The peculiar seasonal variations of the pressure oscillation found by Chapman may be interpreted as due to the seasonal variation of the mean temperatures of the ionosphere and ozonosphere during the course of the year. Some possible mean temperatures are suggested.

The surface wind oscillation computed for one of the profiles agrees with the statistical results within the limits of error, at least as far as the phase is concerned. The vertical structure of the lunar tide is also computed. 48 pages. \$1.00. MicA 55-1466

PHYSICS, NUCLEAR

THE RADIOACTIVITIES OF Sm^{147} AND K^{40}

(Publication No. 12,542)

George Breckenridge Beard, Ph.D.
University of Michigan, 1955

This thesis consists of two parts; a study of the alpha activity of the Sm^{147} isotope and an investigation of the beta activity of K^{40} .

The alpha activity of the Sm^{147} was measured using a proportional counter having 4π geometry. The sources were prepared by evaporating samarium chloride onto thin, aluminized zapon films with the total source thicknesses varying from .06 to .24 milligrams per cm^2 . Both natural samarium and electromagnetically enriched samarium, which contained 78.35% Sm^{147} , were used. The amount of samarium present in each source was determined by means of a spectroscopic analysis. The measured activity of 719 ± 36 counts/sec-gm Sm^{147} corresponds to a half-life of $1.25 \pm .06 \times 10^{11}$ years.

The investigation of the energy spectrum of the alpha particles was carried out by measuring the alpha tracks produced in an Eastman NTA 25 micron nuclear plate after it was placed in contact with a thin evaporated source of the enriched samarium. The resulting histogram showed an energy spectrum that was non-energetic with an alpha particle energy of $2.11 \pm .05$ Mev.

This energy was used, along with an assumed nuclear radius (obtained from the alpha decay data for Gd^{148}), to calculate the expected activity of the Sm^{147} . The calculated activity was found to be less than the measured activity by a factor of about one hundred. This difference cannot be readily explained. In order to get agreement between the two activities one would have to assume either a 6% increase in the measured energy up to a value of around 2.24 Mev. or a 17% increase in the nuclear radius, or possibly some combination of smaller increases in both. Since the

uncertainties in the energy and radius are much smaller than these values, it appears quite unlikely that they could account for all of the discrepancy between the activities.

As a possible explanation an approximate calculation was made to see if some nuclear deformation (specifically, that corresponding to a large positive quadrupole moment with a uniform nuclear charge distribution) could account for the difference. The results showed very qualitatively that one might expect such a nuclear deformation to increase the alpha activity to the right order of magnitude.

In the second part of the thesis the beta spectrum of K^{40} was investigated with the aid of a scintillation spectrometer. By using a comparatively large (31 grams) thallium activated KI crystal as the scintillation element it was hoped that the beta spectrum could be obtained free from distortion at low energies. Then the low energy region could be used to distinguish experimentally between the unique second and third-forbidden correction factors applied to the Fermi plot of the spectrum.

The observed beta spectrum was corrected for the following effects:

- 1) background,
- 2) K^{40} gamma rays,
- 3) resolution,
- 4) electron escape from the surface.

The corrected spectrum was then used to make the Fermi plots. Although the result was an improvement over previous work, it was found that both correction factors linearized the Fermi plot equally well down to an energy of about 200 Kev. To distinguish between them one must find a way of measuring the spectrum free from distortion to even lower energies.

As a check on the validity of the method the beta spectrum of K^{42} was measured in the region above 2 Mev. When the unique first-forbidden correction factor was applied to the Fermi plot it was made linear in agreement with the theory and other experimental results.

By measuring the total activity of the KI crystal the beta activity of K^{40} was found to be $27.4 \pm .4$ particles per second per gram of natural potassium. This result agrees well with other measurements using a 4π geometry. 91 pages. \$1.14. MicA 55-1464

NUCLEAR ELECTRIC QUADRUPOLE INTERACTIONS IN KERNITE

(Publication No. 12,125)

Howard Loran Blood, Ph.D.
University of Washington, 1955

An investigation of the nuclear electric quadrupole interactions of B^{11} and Na^{23} in a single crystal of kernite, the low hydrate of the sodium biborates, $Na_2B_4O_7 \cdot 4H_2O$, has been using nuclear magnetic resonance absorption techniques, by examining the perturbation to magnetic energy levels of these nuclei by nuclear electric quadrupole interactions with internal crystalline fields. Analysis of the frequency dependence of the various transitions involved upon crystal orientation in the magnetic field was made according to the theory given by Volkoff.

The analysis shows there to be four non-equivalent sites for boron in the tetra-molecular unit cell. Two of these sites have strong quadrupole interactions, and two have relative weak interactions, as shown by the magnitudes of the quadrupole coupling constants. It is shown furthermore that there are 4 borons associated with each site, the positions of two being obtained from each other by inversion through the center of symmetry and the positions of the remaining two obtained from these by rotation about the two-fold symmetry axis. The sodium atoms are found in two non-equivalent sites, having relatively strong quadrupole interactions, with symmetry properties like those of the boron sites. None of the sites are found to lie on the two-fold symmetry axis of the crystal.

The electric quadrupole coupling tensor $\frac{\nu_Q \lambda}{eq} \phi_{ij}$ is determined completely at each of the four boron and two sodium sites. It is specified by giving for each site the absolute values of the largest quadrupole coupling constant and the eigenvalue of the electric field gradient tensor, the asymmetry parameter, and the orientation of the principal electric axes.

The results of the analysis conflict seriously with the model for kernite proposed by Portoles. In it, three borons are located in a B_3O_6 group, and one in a B_2O_4 group; also he finds three non-equivalent sites for sodium, two of which lie on the symmetry axis. The information on sodium is therefore in complete disagreement, while the association of the boron into two pairs suggests that Portoles' three and one grouping might be re-examined.

From the experimentally measured values of the pure quadrupole of $|C_z|$ and η the transition frequencies of the pure quadrupole transitions are predicted. Attempts to observe such transitions have proved successful. Pure quadrupole transitions for both B^{11} and Na^{23} in kernite have been observed.

95 pages. \$1.19. MicA 55-1467

THE LIGHT ELEMENTS IN COSMIC RAYS: A DOUBLE-SCINTILLATION-COUNTER EXPERIMENT

(Publication No. 11,964)

Leland Sheaff Bohl, Ph.D.
University of Minnesota, 1954

The charge spectrum of cosmic rays at an atmospheric depth of 14 gm/cm^2 at $\lambda = 41^\circ \text{N}$ was measured using a telescope containing two 6×6 -inch scintillation counters, crossed geiger-counter trays and a 57-gm/cm^2 absorber. The pulse height from each scintillator was recorded when a geiger-counter coincidence indicated the passage of a single penetrating particle. From the record, a scatter diagram is made in which each event is represented by a point whose coordinates correspond to the ionization in each scintillator. The points appearing in clusters along the diagonal of equal ionizations are interpreted as due to the passage of multiply-charged nuclei, after correction for a general background (presumably from nuclear interactions). Correction is also made for loss of telescope efficiency arising from the effect of knock-on electrons. An extrapolated primary alpha-particle flux of $90 \pm 10 \text{ m}^{-2} \text{ster}^{-1} \text{sec}^{-1}$ is obtained. The Beryllium and Boron nuclei counted can be ascribed to the fragmentation of heavy nuclei in the air above the equipment. Within the experimental uncertainties, the data is consistent with the absence of primary L, Be, B, with 0.4 as the upper limit for the flux relative to C, N, O.

56 pages. \$1.00. MicA 55-1468

ALPHA-ALPHA ANGULAR CORRELATION IN $B^{11}(p, \alpha\alpha)He^4$

(Publication No. 12,104)

Ednah Harriette Geer, Ph.D.
State University of Iowa, 1955

Chairman: Professor Edward B. Nelson

The method of angular correlation in the reaction $B^{11}(p, \alpha\alpha)He^4$ enables one to study the properties of excited states in both C^{12} and Be^8 . The angular correlation was studied in this experiment at bombarding energies of 163 Kev, corresponding to the well-known resonance at 16.10 Mev excitation in C^{12} , and of 290 Kev, which is in a nonresonant region. In Be^8 , the reaction proceeds through the first excited state at 2.9 Mev, which is generally assumed to have a spin of 2 and even parity.

The experiment was performed by bombarding a thin target of natural boron with an analyzed beam of protons from the State University of Iowa Cockcroft-Walton accelerator. The alpha particles were detected by NaI flakes, mounted in a plane at 90 degrees to the proton beam. RCA 5819 photomultipliers and conventional amplifiers and coincidence circuits were used to measure the coincidence rate as a function of

the angle between the counters. The energy response of the detectors was found by measuring the efficiency of detection of alpha particles from a polonium source as calibrated foils were introduced to vary the alpha particle energy.

Theoretical angular correlation functions were computed for states with spin and parity of 1-, 2-, 2+, and 3+ in C^{12} , and spins of 2 and 4 in Be^8 . Only the lowest possible value of proton angular momentum was considered, and, if more than two values of angular momentum were possible for the first alpha particle, only the two lowest were considered.

The energy spectrum of alpha particles for this reaction as measured by Whaling was analyzed in order to determine the shape of the level at 2.9 Mev in Be^8 . A numerical integration of the center of mass correlation over the level had to be performed before the theoretical correlations could be compared with the observations. Since the energy of the second alpha particle varies rapidly with angle, the efficiency of the counter was included as a factor in the integration.

Coincidences between the two break-up alpha particles from Be^8 do not contribute to the angular correlation for laboratory angles between 130 and 180 degrees. This corresponds to an angular range of about 90 to 180 degrees in the center of mass system.

Transitions through the ground state of Be^8 contribute to the angular correlation only at angles of 170 degrees or greater. An estimate was made of the contribution at 180 degrees and the results were not sensitive to the correction.

The conclusions from this experiment are as follows: The data at the 163 Kev resonance are consistent with a pure state of 2+ in C^{12} and 2+ but not 0+ or 4+ in Be^8 , assuming that only the two lowest values of angular momentum of the first alpha particle contribute to the angular correlation. The non-resonant correlation at 290 Kev cannot be explained on the basis of a pure C^{12} state with spin 2- or 3+, corresponding to the 675 Kev proton capture resonance, or 1-, corresponding to the 1.4 Mev proton capture resonance, with either spin 2 or 4 in Be^8 . A superposition of these two states with a predominance of the 1.4 Mev resonance satisfactorily explains the correlation. 72 pages. \$1.00. MicA 55-1469

LATTICE SPACE QUANTIZATION OF COUPLED MESON AND NUCLEON FIELDS

(Publication No. 12,267)

Dan Howard Holland, Ph.D.
Stanford University, 1955

The lattice space quantization method used by Schiff for treating non-linear mesons is used in quantizing coupled meson and nucleon fields. Neutral pseudoscalar mesons with pseudoscalar coupling to neutral Dirac nucleons are assumed. Only the fields at the lattice points of a cubic lattice are considered. An appropriate lattice space Hamiltonian is found and

momentum (gradient) terms are treated as perturbations. To zero order the lattice points are uncoupled, so the state function can be written as a product of functions describing a single point. In the representation chosen, finding a particular point function entails the solution of a set of coupled differential equations. These equations can be solved in principle with no assumptions as to magnitude of the coupling constant g , but solutions must be found numerically and this has not been done. Linear combinations of the zero order solutions are found which are eigenfunctions of the lattice momentum operator, and which diagonalize the perturbation to lowest order. The perturbation energy of these states contains a term proportional to k^2 which is interpreted as kinetic energy, while the states are interpreted as one particle momentum eigenstates. Linear combinations of two-particle momentum eigenstates are found which approximately diagonalize the perturbation, and from these scattering cross sections are calculated. The cross sections exhibit the qualitative behavior to be expected from scattering due to a short range interaction. The lattice constant appears in the final results, and must be regarded as a parameter of the theory. In order that the perturbation approximation be valid, l must be large relative to the meson Compton wave length.

142 pages. \$1.78. MicA 55-1470

PHOTONUCLEAR YIELDS OF N^{17}

(Publication No. 12,271)

Daryl David Reagan, Ph.D.
Stanford University, 1955

Yield curves of N^{17} arising from electron and x-ray bombardment have been measured for the elements oxygen, fluorine, neon, sodium, magnesium, and aluminum. Nitrogen-17 was identified by its delayed neutrons which made the measurement of low yields feasible. For the more complex reactions, the photon cross sections are very broad in their dependence and increase in the region of 150-350 Mev. The total photonuclear cross section above 150 Mev estimated from the results reported here is of the same order of magnitude as the photomeson cross sections previously reported. 56 pages. \$1.00. MicA 55-1471

AN EXPERIMENTAL STUDY OF BETA-GAMMA ANGULAR CORRELATION

(Publication No. 11,005)

Stuart Longfellow Ridgway, Ph.D.
Princeton University, 1952

Beta-gamma angular correlation is investigated by scintillation counter coincidence techniques. Results that cannot be distinguished from an isotropic distribution of a following gamma relative to the

direction of the initial beta are obtained for Au^{198} and Sb^{122} , under circumstances in which all energy beta particles are accepted.

For Sb^{124} a fairly anisotropic distribution is found. The corrected angular correlation is observed to be $1 - .23\cos^2\theta$, for electrons above an effective absorber outoff energy of 1.0 mev.

This result, combined with other information on the shape of the beta spectrum, leads to an interpretation in which the decay scheme is $3 \rightarrow 2 \rightarrow 0$, with the gamma probably electric quadrupole, and the matrix element responsible for the beta transition being B_{ij} in the first forbidden tensor or axial vector interaction, or A_{ij} in the polar vector second forbidden. This interpretation is in agreement with the predictions of shell theory if the matrix element is taken to be B_{ij} , for then the shell theory assignment of spins and parities of the states involved agree. The interpretation using the matrix element A_{ij} requires the assignment of parities in disagreement with the shell model. 92 pages. \$1.15. MicA 55-1472

ANGULAR CORRELATION OF CASCADED GAMMA RADIATIONS FROM ORIENTED NUCLEI

(Publication No. 12,188)

Richard Cassell Sapp, Ph.D.
The Ohio State University, 1955

The angular correlation between successively emitted nuclear gamma rays has been measured for nuclei oriented at low temperatures. The radioactive nuclide used was cobalt-60, which undergoes beta decay to the second excited state of nickel-60, followed by two cascaded gamma emissions. The gamma-rays were detected by scintillation counters, and both the angular distribution and angular correlation were determined by means of suitable coincidence and counting apparatus. The cobalt-60 nuclei were incorporated in single crystals of cerium magnesium nitrate, which were then mounted in a cryostat and cooled to the order of 0.003°K by adiabatic demagnetization. Nuclear orientation was obtained through the hyperfine interaction between the cobalt-60 nuclei and ionic structure, the latter being polarized by means of a moderate externally applied magnetic field. An approximate determination of the

sample temperature was provided by measurements of the susceptibility of the crystal.

The experiments were made possible through recently developed techniques in the field of low temperatures and in nuclear radiation detection. Adiabatic demagnetization makes it possible to attain the low temperatures necessary for appreciable degrees of nuclear orientation, and the combination of energy discrimination and short coincidence resolving times ($\sim 10^{-8}$ sec) afforded by scintillation counters and associated circuits permits the determination of the angular correlations with negligible interference from random background and scattering. In order to obtain sufficient statistical precision in the coincidence measurements, it was necessary to combine the results from several demagnetizations.

The significant experimentally determined parameters are the departure of the individual gamma-ray distributions from the isotropic pattern which holds at room temperature, and the angular correlation, expressed as the ratio of the coincidence rates at 180° and 90° .

The theory developed in 1952 by Cox and Tolhoek predicts that the angular correlation will be strongly affected by nuclear orientation, and that whether the correlation is increased or decreased depends on how the radiation detectors are placed with respect to the direction of alignment. The present measurements confirm the theoretical predictions, both in magnitude and direction, and in favorable cases establish angular correlation measurements on oriented nuclei as an experimentally feasible method of investigating properties of nuclear states.

In order to minimize the dependence of the results on explicit knowledge of the temperature and magnetic state of the cobalt ion, the angular correlation is displayed as a function of the distribution anisotropy. This relationship is practically independent of the mode of beta-decay which precedes the gamma transitions and appears to be insensitive to the details of the orientation mechanism at the moderate degree of orientation obtained. The good agreement found between theory and experiment indicates the absence of any appreciable perturbation of the intermediate nuclear state; this in turn implies that the lifetime of this state is not greater than about 10^{-11} seconds, a magnitude consistent both with the results of other investigators and with the theory of photon emission.

201 pages. \$2.51. MicA 55-1473

PHYSIOLOGY

PHOTOREVERSAL OF NUCLEAR AND CYTOPLASMIC EFFECTS OF SHORT ULTRAVIOLET RADIATION ON SOME PROTOZOANS

(Publication No. 12,260)

Charles Lawrence Brandt, Ph.D.
Stanford University, 1955

An investigation of effects induced in some ciliate protozoans by quartz transmitting wavelengths shorter than 248 mμ was carried out. Observable cytological effects and division delay due to these wavelengths were noted. The capacity for photoreversal of these effects was compared with the photoreversibility of effects produced by longer wavelengths of ultraviolet. The relationship of the interdivisional age of the animals to the degree of ultraviolet induced injury and of subsequent photoreversal was studied.

By modifying a large size natural quartz monochromator with an atmospheric pressure mercury arc lamp source, the ultraviolet wavelengths 226 mμ, 233 mμ, and 239 mμ were obtained in sufficient intensities for biological studies. Three protozoans, *Colpidium colpoda*, *Didinium nasutum*, and *Paramecium caudatum* (grown in two-membered cultures in lettuce medium), were used as experimental organisms for cytological observations and determination of the division rates of single clones in isolation tubes after various treatments.

Lethal doses of wavelengths 226 mμ, 233 mμ, and 239 mμ induce death in each of the three ciliates, with changes in the protoplasm indicating a superficial action of the radiation. Sublethal doses of these wavelengths produce rapid immobilization of the ciliates due to cessation of beat and loss of the cilia. Recovery from minimal immobilizing doses occurs in 80% of the paramecia immobilized by 226 mμ; the subsequent division delay is slight. At longer ultraviolet wavelengths the degree of recovery of *Paramecium* from minimal immobilizing doses diminishes, and the amount of division delay increases.

A partial action spectrum of this immobilization effect in *Paramecium* was determined for wavelengths 226 mμ, 233 mμ, 239 mμ, 248 mμ, and 267 mμ by noting visually the time of immobilization of the animals during the irradiation. The spectrum thus obtained closely resembles the absorption spectrum of protein. Visible light applied concurrently with any of the above five wavelengths of ultraviolet results in photoreversal of the division delay, but not of the immobilization.

The capacity for photoreversal in *Colpidium* subsequent to irradiation decreases with dark incubation, and is completely lost by the first post-irradiation division. In *Didinium* and *Paramecium* the capacity for photoreversal subsequent to irradiation

decreases, and is lost with the second post-irradiation division.

The results suggest that nuclear nucleoprotein absorption may induce photoreversible effects, and absorption elsewhere in the animal may induce non-photoreversible effects.

205 pages. \$2.56. MicA 55-1474

CHANGES IN FIBROBLASTS IN VITRO AFTER PERFUSION WITH STEROIDS

(Publication No. 11,587)

Ronald William Gillette, Ph.D.
University of Pittsburgh, 1955

An attempt is made in this investigation to relate the exact structure of certain steroidal compounds with their physiological action on connective tissue cells *in vitro*. A recently developed perfusion technique makes it possible to maintain fibroblasts *in vitro* for long periods of time. By virtue of this fact low concentrations of steroids could be added to the perfusion medium, and the effects of long intervals of contact between the cells and the steroid could be ascertained. Because very low concentrations of the steroids were used such side effects as irritation could be held to a minimum.

Since the cells used for the major portion of this investigation were fibroblasts the adrenal steroids were expected to yield the most striking results.

11-desoxycorticosterone acetate and 17-hydroxy-11-desoxycorticosterone acetate were found to increase greatly the volume of the cytoplasm of the fibroblasts. A great increase in the size of the nucleus and heterochromatic material within the nucleus was also observed. The mitochondrial elements were found to be correspondingly more numerous. The movement of the various organoids within the fibroblasts was found to be normal. Cortisone acetate caused a slight decrease in the cytoplasmic and nuclear size. The cytoplasm was also unusually hyaline in appearance. Such closely related steroids are pregnenolone, estradiol, and cholic acid failed to produce changes in the cells. The changes produced by 11-desoxycorticosterone acetate were irreversible while those of cortisone acetate were not.

A degree of competition was demonstrated between 11-desoxycorticosterone and cortisone acetate. If the two compounds were perfused over the fibroblasts simultaneously, then the time required to produce the 11-desoxycorticosterone effect was greatly increased. The time varied with the ratio of the two steroids in the medium. Epithelial cells perfused in exactly the same manner as the fibroblasts and with the same

concentration of desoxycorticosterone failed to show a response to the steroid.

Mouse and chick fibroblasts were used in this investigation. The fibroblasts gave an identical cellular response to desoxycorticosterone regardless of the source. The only difference noted was that mouse fibroblasts responded somewhat faster than the chick to the steroid.

The cells treated for long periods of time with 11-desoxycorticosterone bore a striking resemblance to malignant connective tissue cells produced by other means.

An attempt is made to correlate the desoxycorticosterone effect with other findings. Desoxycorticosterone has been shown to influence wound healing in numerous animal species. There has been reported an increase in the size and a stellate appearance of fibroblasts in wounds *in vivo*. There was also reported a large number of mitotic figures. That other hormone factors are operative on the cellular level in wound healings is demonstrated by the fact that extremely few mitotic figures were noted in this study. The fibroblasts from granulation tissue were also comparatively much smaller than those observed *in vitro*.

Cortisone has been shown to slow the process of wound healing *in vivo*. Also a hyaline appearance of the cytoplasm similar to our cortisone treated cells *in vitro* was reported. Also, desoxycorticosterone is known to suppress transaminase reactions in tissue slices *in vitro*. The cause of the changes reported here is apparently to favor protein synthesis at the expense of the transaminase reactions, thus accounting for the great increase in the cell volume. This is also correlated with the fact that malignant and fetal cells and cells from areas where regeneration is occurring are low in transaminase.

68 pages. \$1.00. MicA 55-1475

COMPLEMENTARY MILK AND ITS RELATIONSHIP TO LACTATION

(Publication No. 11,983)

James H. Koshi, Ph.D.
University of Minnesota, 1955

Since Ott and Scott (1910) first reported that the injection of pituitary extract greatly increased the flow of milk, it was shown that the injection of pituitary extract into a lactating animal milked "dry" made more milk available. That extra milk made available is called "complementary milk." The active principle in the pituitary extract was found to be oxytocin by Ely and Petersen. It has been reported that the amount of complementary milk available ranged from a fraction of a pound in some animals up to 14 lb. in some. There are reports theorizing and suggesting that the amount of complementary milk influences persistency. The questions raised were just what is the extent of complementary milk available and what is its effect on persistency.

It was found that to determine the amount of complementary milk the following steps should be followed: 1. Milk the cows "dry"; 2. Administer ten units of oxytocin intravenously; 3. Hand-strip for complementary milk.

Employing the procedure stated above, it was found in 1327 trials involving 62 cows that the amount of complementary milk available ranged from 0.1 to 13.3 lb. with the mean of 1.7 lb. The amount of complementary milk representing the total amount of milk obtained ranged from 1.2 to 70.9% with the mean of 11.3%. The butterfat percentage of complementary milk ranged from 6.1 to 22.5% with the mean of 13.2%.

The use of oxytocin once a week to remove complementary milk had no detectable influence on milk production.

The absolute amount of complementary milk decreased with the decrease in production and decreased with the progress of the lactation to the extent that the amount of milk decreased with the advance in the stage of lactation. The per cent complementary milk was independent of the stage of lactation, the age of the animal, and the level of production.

When the index of persistency was calculated on 46 animals according to the method developed by Ludwick and Petersen, it ranged from .001 to .972 which meant that the persistency of the animals ranged from practically no persistency to ones having a nearly ideal lactation curve. There was no significant relationship between persistency and the age of the animal, yield at peak of production within a lactation, and the trend of butterfat percentage within a lactation. It was found that the animals with poor persistency reached the peak of production earlier in lactation and declined rapidly.

The most significant finding was that as the per cent complementary milk increased the persistency of lactation decreased. The correlation coefficient between the per cent complementary milk and persistency of lactation was -0.78 which was highly significant. The significance of the above finding should be of special interest to dairymen. First of all, it seems that there must be considerable economic loss to the producers because the milk not removed at each milking occupies the udder space which reduces the space necessary for the subsequent secretion. Secondly, the decreased persistency of lactation will result in additional loss in milk production. The total loss in the animals with high per cent complementary milk may amount to a considerable quantity.

This study of the complementary milk and its relationship to lactation has revealed very important factors which have been ignored thus far in dairy cattle breeding and to a lesser degree in management practices. It is felt that some tool for the application of the findings should be developed and applied in the field of dairy cattle management and breeding.

71 pages. \$1.00. MicA 55-1476

RESPIRATORY AND CIRCULATORY RESPONSES
OF ANIMALS DURING THE ADMINISTRATION
OF CONTINUOUS POSITIVE
INTRAPULMONIC PRESSURE

(Publication No. 12,176)

George Herman Kydd, III, Ph.D.
The Ohio State University, 1955

One of the problems associated with the flight of man at high altitudes is that of supplying an adequate atmosphere to meet his requirements. Present-day aircraft have solved this problem by the use of pressurized cabins, but this method is not the complete answer to military requirements, and its use becomes more limited as altitude increases. Military air crews are subjected to the possible loss of cabin pressurization as a result of enemy action, and should be supplied with something resembling a space suit that has its own atmosphere.

The space suit has not been fully developed, and in its absence attempts are being made to counteract the effects of positive intrapulmonic pressure by the use of mechanical pressure applied over the body. Since it is impossible to supply mechanical pressure evenly over the entire body, certain undesirable effects are produced. These developments have brought about a renewed interest in the respiratory and circulatory adjustments to high intrapulmonary pressures.

A series of experiments has been carried out to study the effects of pressure breathing at 50 mm. Hg on respiration and circulation. Twelve anaesthetized dogs were fitted with an inflatable bladder suit, the bladder of which was connected to the trachea. Alveolar $p\text{CO}_2$, arterial and venous pressures, respiratory flow, intratracheal pressure, and sometimes alveolar $p\text{O}_2$ were recorded. The responses of the animals were recorded while they breathed at least three of four gases: 100 per cent oxygen and 4.84 per cent CO_2 , 9.48 per cent CO_2 , and 15.13 per cent CO_2 , all in oxygen.

The principal respiratory effect of pressure breathing was one of inhibition. This was evidenced by the apnea which followed the application of pressure in all the animals. The apnea seemed to have a number of parameters including the tension of CO_2 in the expired air, the magnitude of the intrapulmonic pressure, and the depth of the anaesthetic. When breathing began again, it was reduced both in rate and depth. The breathing pattern was modified so that inspiration became the most stable and reproducible part of the cycle. Expiration varied considerably, from that of animals which make expirations that appear normal to that of animals that exhale slowly during long apparently apneic periods.

Immediately following application of pressure, there is a sudden increase in arterial pressure, taking place in about two seconds, followed by a fall in mean pressure, a decreased pulse pressure, and an increase in heart rate. There follows a rise in mean pressure in which the initial blood pressure level may be attained. This compensation is brought about by at least three mechanisms: peripheral vasoconstriction, contraction of abdominal and thoracic musculature, and external support. The most variable factor in these experiments was probably the external support, since it depended on how well the animals fitted the suit. If the fit was good, i. e., tight, compensation was good and mean pressure returned to its initial level.

On the basis of this work, an attempt is made to show that the response of animals and man are essentially the same, and that the amount of support, whether voluntary as in an active Valsalva maneuver or external as in these experiments, determines to a great extent the type of response obtained.

The results indicate that the sensitivity of the respiratory center for CO_2 is reduced during pressure breathing at ground level and at altitude. Therefore, if normal ventilation is maintained during pressure breathing in human subjects, it is brought about in part by a conscious effort. The loss of consciousness may mean loss of this means of adjusting the respiration and the acid-base balance of the body.

105 pages. \$1.31. MicA 55-1477

POLITICAL SCIENCE

POLITICAL SCIENCE, GENERAL

PRESSURE FOR FREEDOM: THE AMERICAN CIVIL LIBERTIES UNION

(Publication No. 11,893)

Barton Bean, Ph.D.
Cornell University, 1955

This study describes and assesses the activities of the American Civil Liberties Union, a private group which exists to promote civil liberty by influencing the public and the government. Much of the story of how it has done this involves developments in the field of civil liberty in the United States since 1914, and the relationship between the Union's efforts and such developments. Although the formation of a predecessor group and its activities during the First World War are rather fully treated, the study is not a history of either the Union or the times. The bulk of the study deals with the Union's make-up (structure, personnel, finances), important examples of its activities (general operations, publications, publicity, lobbying, local organizations and activities), plus such important overall matters as its struggles to be true to its ideals. All of these are described and discussed primarily in terms of development and the related changes which have come about both within the organization and in the society in which it operates.

The study is based upon source materials including mainly: the huge files of the ACLU itself partly in public depositories and partly in its own offices; a large number of autobiographies, biographies, memoirs, conversations and letters by, with, and about leading participants, an unusually articulate and distinguished group; journalistic and similar materials which show the Union's effects.

In the development of all these matters a number of themes come to the fore. They include: the rise of the organization from little more than an unpopular ad hoc group to its present status of permanence, considerable size and respectability - from rags to riches; the continuing influence of the same nucleus of people from the early days until the 1950's - permanence within change; the shifting emphases of the organization that came with success, which include such as the shift from relative speed to greater deliberation, that from mere reaction against specific occurrences to a greater initiation of positive programs, and that from mere hostility to government to near-partnership with government in some matters. The study also shows that, roughly speaking, the Union has been most successful in the courts, somewhat less so in legislative and administrative lobbying, least of all in broad education or propaganda.

This pattern neatly parallels the developments within the field of civil liberties, where we now have great legal protection, but increasing pressures in the legislative halls, and perhaps even more among the general public, attempting to circumscribe liberty. The greatly changed situation in the field, in part due to the activities of the Civil Liberties Union, in turn poses problems for the organization. This study, while it cannot predict whether the Union can change its tactics, emphases, and perhaps to some extent, its philosophy to meet the new threats to liberty, posed in a different and broader way than before, at least shows that it has had flexibility enough in the past to adapt itself to new problems.

The broad picture which emerges from the entire study, and which deserves further development, is an inspiring one. The fundamental tenet of the organization that liberty and a democratic government can go hand in hand has proved sound. The relationship of the Union, pledged to protect the right of dissent, and the government, which often fears dissent, has shown the effectiveness of private groups in promoting the public welfare, has shown the responsiveness of our government, but most of all has shown the strength of the democratic way.

432 pages. \$5.40. MicA 55-1478

AN INQUIRY INTO THE ETHICAL FOUNDATIONS OF DEMOCRACY

(Publication No. 12,016)

Samuel DuBois Cook, Ph.D.
The Ohio State University, 1955

Adviser: David Spitz

Democracy is a form of political organization which makes power responsible through the free play of conflicting ideas. Defenders of democracy assume that it is a better system of government than any of its alternatives. Since the term "better," like the term "good," is an ethical predicate, any adequate justification of democracy must come to grips with its moral foundations. Why is democracy "better"? How do we know? In an age when democracy is vigorously challenged, these questions demand consideration.

Of the many contemporary thinkers who have sought to establish the ethical validity of democracy, seven representative spokesmen have been selected for intensive examination. They signify both the variety of approaches to the ethics of democracy and the richness and vitality of the democratic philosophy.

Christian theories of democracy are represented by Jacques Maritain and Reinhold Niebuhr. The good, according to M. Maritain, is derived from natural law which, in turn, expresses the rational character of man. Natural law prescribes certain natural rights, one of which is self-government. Democracy is justified, therefore, because it is deduced from natural law.

Somewhat different from the Catholic doctrine of natural law is Reinhold Niebuhr's effort to root democracy in the Protestant doctrine of original sin. Man's pride, Niebuhr holds, corrupts all his conceptions and perceptions. Men are thus inherently inclined to injustice, a propensity that is aggravated by irresponsible power. Democracy, in conjoining power and accountability, checks this inclination to injustice.

Of the secular theories of democracy, the naturalistic approach of John Dewey, based on his belief in the unity of science, is of major importance. As the scientific method is, for Dewey, that of reflective and experimental intelligence, so democracy is held to be the application of that method to political processes. In consequence, democracy alone provides the necessary conditions of human growth and fulfillment.

For Robert M. MacIver, the essence of democracy is the responsibility of power. In achieving this, democracy both conserves and enriches the value of the individual personality and promotes the common good.

W. T. Stace attempts to validate democracy by rooting it in the Greek doctrine of the primacy of reason and the Christian doctrine of the primacy of sympathy – both of which are, in his view, conditions of the good life.

That democracy is grounded in the nature of human thought is the thesis of Homer H. Dubs. The structure of human thought, Dubs argues, entails the notion that only the competent and the impartial have a right to make judgments. Democracy alone, Dubs believes, conforms to this logical criterion.

The last of our secular theorists of democracy is Marie Collins Swabey, who takes the view that democracy's moral superiority can be demonstrated through logical and mathematical propositions. Democracy, she holds, is anchored in the mathematical conception of equality and the logical law of identity. As science applies the quantitative method to the world of natural phenomena, so democracy applies it to the political dimension.

Each of the foregoing constructions – both Christian and secular – contains insights into the ethical character of democracy. But no formulation alone is both necessary and sufficient. Each formulation involves, in part at least, indemonstrable assumptions, and it is not always clear that the conclusions of the respective authors follow from their presuppositions. Each theory, however, moves in the right direction: it seeks to validate democracy in terms of moral goodness. Moreover, these seven justifications give impressive weight to the belief that democracy is of perennial validity because it is rooted

in the yearnings of the mind and spirit for freedom from external control and arbitrary authority.

398 pages. \$4.98. Mic 55-147

THE TRADITION OF CONSTITUTIONALISM:
A STUDY CONCERNING THE BACKGROUND
OF MONTESQUIEU'S THEORY
OF THE SEPARATION OF POWERS

(Publication No. 10,898)

Gisbert Henry Flanz, Ph.D.
Princeton University, 1947

Montesquieu's originality has frequently been disputed ever since the publication of his *Spirit of Laws* nearly two hundred years ago. Continental jurists who searched for the "true originator" of the idea of the separation of powers usually pointed to Aristotle's description of the three governmental powers and a number of later authorities who allegedly anticipated Montesquieu. They failed to notice that Montesquieu's doctrine was more complex than Aristotle's idea of the *trias politica*.

It is futile to search for individual writers from whom Montesquieu might have "copied" the idea of the separation of powers. The doctrine emerged gradually from a fairly continuous tradition of constitutional thought. The object of this study has been to reconstruct the origin of the theory of the separation of powers, not by searching for individual "forerunners" of Montesquieu but by presenting the historical and philosophical background from which the idea evolved.

Students of political thought are aware of the close relationship of the doctrine of separation of powers to the traditional theory of mixed government. Many of them also realize that the concept of checks and balances is inherent or implicit in the idea of mixed government. All these ideas are philosophically and historically interrelated.

Philosophically or ideologically these related ideas are based on the assumption that men will always tend to abuse power entrusted to them. The idea of mixed government represents an early form of preventive constitutionalism in so far as it aims to forestall upheavals. Montesquieu sought to prevent the abuse of political power by a distribution of political powers in different hands who were to check each other in the process of operations. It is important to appreciate that this philosophical foundation of constitutional thought is not so much based on *a priori* assumptions as on definite historical experiences.

The idea of mixed government as expounded in the writings of Plato and Aristotle is justified by their reference to the proven instability of pure forms of government. Mixed government was found to be the relatively most stable system because it was based on a sound compromise between different social elements whose ambitions counteracted each other. This

empirical view was also entirely compatible with the prevailing peripatetic philosophy of moderation.

It was Polybius who converted the philosophical idea of mixed government into a workable scheme of constitutional government. In glorifying the constitutional system of the Roman Republic he developed a most intricate yet realistic scheme of checks and balances which was to safeguard the republican Constitution. Thus around 200 B.C. the Constitution of Rome became the first historically established model constitution. Later constitutionalists argued that all model constitutions known to history had been based upon the principles of mixed government with its implicit scheme of checks and balances.

The historical successor to the Roman Model Constitution was that of Venice which enjoyed a tremendous prestige around 1500. Venetian constitutional thought was based upon the Roman heritage, especially upon Polybius.

For as appreciation of the continuity of constitutional thought it is important to point out that the Venetian speculations on mixed government and checks and balances had a profound influence in England. The reflections of Contarini, Guicciardini and Gianotti left clear imprints upon the English constitutional tracts of the 17th Century.

In this study it is shown how the idea of mixed government implemented by a sound scheme of checks and balances became the foundation of the English model constitution which after 1700 made such a deep impression upon continental publicists. Several English constitutionalists writing decades before Montesquieu came very close to anticipating him.

Montesquieu did not derive his doctrine from abstract philosophical speculations. Von Ranke was right when he asserted that Montesquieu's theory was an abstraction from history and a program for the future. Montesquieu designed it primarily for the government of France, but he realized that with minor modifications it might have general validity in western political systems.

224 pages. \$2.80. MicA 55-1479

URBAN REDEVELOPMENT AND REHABILITATION IN COLUMBUS, OHIO

(Publication No. 12,175)

Donald Jean Kreitzer, Ph.D.
The Ohio State University, 1955

The purpose of this study is to determine the status of and the prospects for urban redevelopment and urban rehabilitation in the city of Columbus, Ohio, as of 1954.

The study consists of two parts. The first part (Chapters I to IV, inclusive) is given principally to background material. This material consists of 1) a brief review of the national history of urban redevelopment and urban rehabilitation, 2) an analysis of the lessons learned therefrom, and 3) a summary of the conditions of blight in Columbus. The second and

major part of the study (Chapters V to X) consists of a review of the programs in Columbus that are a direct or indirect part of local efforts at, and plans for, redevelopment and rehabilitation. The programs so reviewed are the Columbus planning program, the Columbus downtown off-street-parking program, the Columbus public housing program, the Columbus program to facilitate private redevelopment, and the Columbus rehabilitation program.

Several serious faults were found in these programs. The Columbus downtown off-street-parking program is inadequate. The Columbus rehabilitation program is defective in that it is based upon an inadequate housing code, does not have enough inspectors, and is carried out by an agency, the Department of Health, that has neither the legal powers nor the staff to do replanning. The Columbus program to facilitate private redevelopment will remain in the planning stage until the City's electorate approves financing for the program, and until much more public housing is built to provide relocation housing for the low-income families that would be displaced by that program's proposed redevelopment projects. Any substantial increase of public housing appears to be blocked by the opposition of the Columbus Home Builders Association and the Columbus Real Estate Board.

Most of these defects and difficulties can be, and in some instances are about to be, remedied or overcome. The downtown off-street-parking program almost certainly is to be expanded. A new and adequate housing code soon may be enacted. A careful campaign apparently will be waged in behalf of the bond issue for redevelopment expected to be on the ballot in November, 1955. And even the influence of the Home Builders and of the Real Estate Board may well be overcome as the downtown businessmen come to realize that an extensive program of private redevelopment carried out near the center of the City is essential to their continued prosperity, and that substantially more public housing is, in turn, essential to the realization of such a program.

262 pages. \$3.28. MicA 55-1480

THE NATIONALIST ARMY OF CHINA: AN ADMINISTRATIVE STUDY OF THE PERIOD 1924-1946

(Publication No. 10,950)

Frederick Fu Liu, Ph.D.
Princeton University, 1951

Abstract not available.

425 pages. \$5.31. MicA 55-1481

THE EFFECTS OF GOVERNING
ON THE BRITISH LABOUR PARTY

(Publication No. 11,909)

Gerhard Loewenberg, Ph.D.
Cornell University, 1955

Although it is well known that modern or so-called "mass" parties are characterized by oligarchic tendencies, extra-parliamentary discipline, and doctrinaire attitudes which threaten to upset the democratic systems of government in which they operate, it is not generally realized that these parties may in turn be affected by the arrangements of government. They may thereby be conditioned to conform to those requirements of party behavior on which the functioning of democratic government depends. This is especially possible in countries where the constitution is a potent force. A study of the British Labour Party between 1945 and 1951 reveals that the power and outlook of the party leaders were influenced not only by the party they led but, to a significant degree, by the position in government which the constitution assigned them.

The power and prestige attendant upon members of the Government were used by the Labour Party's Parliamentary leaders in order to control the party organization both in Parliament and outside. They were successful in dominating the party's National Executive Committee, an almost self-perpetuating oligarchy strategically situated in the structure of the party. From this position, and with the aid of the large but politically passive trade union element within the party, they were able to subdue the party's militant rank and file membership. An examination of the party Conference reveals how the oligarchical party structure proved receptive to the control of the parliamentarians and how completely the party's active membership was reduced to a useful but uninfluential role not unlike that of the election committees in older types of parties.

Having been freed from narrow partisan control, the viewpoint of the party's Parliamentary leadership was heavily affected by its position in the Cabinet, the administration, and Parliament. Government power involved global responsibilities which in many instances required modification of the party program or the elimination of its practical inconsistencies. For example, the Socialist predilection for redistributing the national income was increasingly forced to give way to a concern for increasing the total income. Existing administrative procedures were resistant to changes which the party proposed, particularly with respect to national economic planning. Experience with the operation of Parliament caused the reversal of the hostile and even revolutionary attitude which the party had exhibited toward parliamentary institutions during the 1930's. Implementation of nationalization policies, which formed the most distinctive part of the party's election platform, decisively altered the party's position on this subject. The multiplicity of purposes which stood behind nationalization in theory, ranging from social control of industry to increased industrial efficiency, gave

rise in practice to serious conflicts which created dissatisfaction with the program. Furthermore, nationalization policies, which had been developed in the two decades before Labour's advent to power, proved irrelevant to Britain's most pressing economic problems during the party's years in office. Thus by 1952 nationalization had been turned from a favorite dogma to a major embarrassment for the party.

The experience of full power served therefore to modify party doctrine and to support the party's moderate elected leadership against its militant non-elected membership. The structural and programmatic characteristics of a "mass" party were in this instance induced to yield to the needs of the constitutional system and the nation. It is significant that this accomplishment was due to the working of the constitution itself in the sense that it was the extensive governing power which the constitution affords to the majority party which was primarily responsible for the impact of office on the Labour Party.

240 pages. \$3.00. MicA 55-1482

LOCAL GOVERNMENT IN JAPAN

(Publication No. 12,273)

Kurt Steiner, Ph.D.
Stanford University, 1955

The occupation authorities in Japan attempted to foster democracy by establishing local self-government. This attempt can be considered successful only to the extent to which the legal reforms were followed by changes in the actualities of political and social life. The purpose of this study is to determine the degree of local self-government actually existing in Japan. This requires an analysis not only of the institutions of local government, but also of their operation and of the sociological and historical forces influencing them.

Part I surveys the development of Japanese local government from the Tokugawa Era to the end of the Occupation. Local autonomy in the present meaning of the term did not exist during the feudal period and a number of factors prevented its development along the lines of Western countries. (Chapter I). The Meiji leaders created a highly centralized system of government which was not only in line with the needs of the time, as they saw them, but also with their own autocratic inclinations. (Chapter II). Chapter III describes this system and Chapter IV shows its development during World War II. The final two chapters of Part I deal with the occupation reforms in the field of local government, such as the dissolution of the Home Ministry, the abolition of the neighborhood associations, the enactment of the constitutional provisions for local self-government and of the Local Autonomy Law, the local finance reform and the decentralization of police and education.

Part II is entitled "Local Government in Present-Day Japan." After a discussion of the constitutional provisions and their effectiveness (Chapter VII) the

existing local government areas and the tendencies toward recentralization inherent in certain present reform programs are described. (Chapter VIII). Chapter IX deals with *buraku*, *oaza* and *chō*, units which lack legal recognition but which are less artificial than the legal units, and discusses the traditional notions which operate in them and their changing significance in the present transitional stage of Japanese society. The next chapters demonstrate how the lack of a clear-cut allocation of local functions and the financial dependence of local entities on the central government prevent the achievement of a meaningful local autonomy. (Chapters X and XI). These factors, together with traditional notions of hierarchy between the levels of government and with administrative practices of the past, which continue under the new system, provide the basis for a broad extra-legal guidance which the central government exercises in addition to the control based on scant legal rules. (Chapter XII). The actual work of the local executives and legislatures is then viewed within this context. (Chapter XIII). Chapter XIV analyzes local citizen participation. A conservative pattern, based on traditional notions, deprives this participation of its democratic function of determining the will of the local entity. It competes with an emerging progressive pattern which, while still relatively weak, appears to be in accord with the breakdown of the traditional notions underlying the conservative pattern and with the tendencies in Japanese society resulting from such phenomena as industrialization and urbanization.

Several conclusions emerge from the study. The reforms aiming at establishment of local autonomy remained incomplete. Law and actual practice differ significantly. Long-range tendencies in favor of the growth of local autonomy are offset by present governmental policies, aiming at recentralization even in the narrow field where the reforms became effective, but may, nevertheless, prevent or, at least, slow down a return to the complete centralization of the past.

384 pages. \$4.80. MicA 55-1483

POLITICAL SCIENCE, INTERNATIONAL LAW AND RELATIONS

ARAB UNITY: TRENDS AND INTERNATIONAL IMPLICATIONS

(Publication No. 10,939)

Omar Abou Khadra, Ph.D.
Princeton University, 1949

The Middle East today, more than ever before, is the scene of international conflict. It has assumed a position of great significance because of its strategic importance in the East-West struggle and in the discovery of oil reserves surpassing those of any other

region. In a sense, the Middle East is a border area between the two greatest powers. Therefore, its security and stability is essential for the safety and defense of the West. Likewise, Soviet Russia considers the Middle East a safety zone and is vitally concerned regarding its future status. The Russian policy of expansion would seem to indicate that it covetously views that area. If the Western powers can be expelled, the Soviets would be in a position to supplant them.

The Middle East cannot withstand the shock of Communistic attack without substantial assistance from the West. The area *per se* is a power vacuum incapable of defending itself from external aggression. Western policy with regard to the Middle East could pursue one of two courses: abandonment of the area, leaving it prey to the expanding Soviet Union or safeguarding its borders from Russian advances. The West chose the latter course.

It is to the interest of the West, as well as to the security of the Middle East, that the various countries of the region work harmoniously together. The creation of a Middle Eastern bloc oriented to the West would strengthen the security of the area. The Oriental bloc should be a party to the future Mediterranean Pact. The new Pact would have to be linked to the Atlantic Pact. Peace in the world is indivisible; unless concerted action is taken to preserve peace everywhere, a war breaking out could spread all over the world.

Supremacy of the West in the area will depend, however, on the conformity of its policies and activities to the aspirations of the Middle Eastern population. Each area on the globe has to face two problems: internal and external. In its internal aspect, this study is confined to the Arab area of the Middle East. It was found impossible, for reasons of geography and strategy, to treat the external aspect without reference to the other non-Arab countries of the region. The security of the Arab states is dependent on the safety of their northern neighbors that form a buffer region between them and the Soviet Union. The external and internal problems do not only overlap but are directly interdependent. Peace and security is contingent on external security as well as on internal stability and prosperity. These two related factors must be considered as a whole and dealt with accordingly.

The Arab East is undergoing a crisis that may determine its course for centuries. Although it will be necessary for the West to render assistance to the Arabs, they must assume the initiative. In reaching for a solution, the Arabs must unite. Unity is the basic theme of this study. The need for unity is threefold: first, to attain national objective; secondly for purposes of defense and security; and thirdly, to accomplish social and economic reform. Unity in short would strengthen external security and result in internal stability and prosperity.

The following pages consist of eight chapters. The first two treat of the position of the Middle East in international policies. The relations of that area with each of the major powers is discussed. The Middle East region cannot be indifferent to the developments

in the outside world. The alignment of the Middle East to the Western powers is considered of mutual advantage to both. Their relations should be regulated in a spirit of friendship and cooperation. A policy based on force and domination is no longer adequate. The changing attitude of the Western powers reflects this view. Western complacency, disinterestedness and the employment of force should be replaced by a positive cooperative program. Chapter three considers the internal aspect of the problem. It deals with the factors of Arab nationalism, its assumption, and its objectives. The genesis of Arab nationalism and its development from the closing years of the nineteenth century through World War I is discussed. The fourth chapter treats of the conditions of the Arab states following the Versailles Settlement of 1919 up to the fall of France in June 1940. The objective of unity during this period was temporarily relegated to the background, although it remained in the minds of the nationalists.

The fifth chapter describes the circumstances that led to the formation of the Arab League. It appraises the changing British attitude towards the unity movement. The Arab League gave a qualified expression to the need for Arab unity. The activities of the League are treated in the two subsequent chapters. Chapter six deals with its non-political aspects, while the seventh refers to its political activities. Notwithstanding the apparent dissension among the Arab rulers, the League is considered to have furthered the cause for unity.

The final chapter is mainly speculative, being concerned with the future. It urges the Arabs to unite in a federation. It advocates the introduction of short and long term reform projects. The existing political, economic and social structures should be changed. The new Arab federation should be linked to a larger Middle Eastern association. The West should assist in the formation of that bloc. The West should help the Middle East in developing their countries. If the aforementioned internal and external measures are effected, then it is possible to look forward to a relatively prosperous and stable Arab federation.

In the course of preparing this dissertation, the writer has drawn upon various kinds of sources and materials: documents, books, pamphlets, periodicals, articles, and press dispatches. Sources available only in Arabic were extensively used. Particular thanks are due Professors H. Sprout and W. L. Wright for the invaluable criticisms and suggestions which they have rendered.

409 pages. \$5.11. MicA 55-1484

FRENCH NORTH AFRICA IN THE ATLANTIC COMMUNITY

(Publication No. 12,270)

John Arthur Marcum, Ph.D.
Stanford University, 1955

Since the end of World War II, the relationship of North Africa to the Atlantic community has assumed an increasing significance. The associations of Algeria, Morocco, and Tunisia with the West are worthy of inquiry and analysis from two perspectives: (1) an examination of the direct ties between the North African countries and France, the Atlantic nation which rules them; (2) a survey of the largely indirect associations and connections between North Africa and Atlantic community organizations and states other than France.

The historical and geographic settings of North Africa serve as a background for introducing the central problem, namely the struggle between proponents of French rule and western integration and the supporters of North African nationalism. Since the creation of the Fourth Republic, there has been an effort to prescribe a constitutional relationship between North Africa and France in terms of the French Union. This has been legally feasible for the "province of Algeria" but not with Morocco and Tunisia, which remain only French protectorates under international law.

The political, economic and social conditions in the three North African countries reveal much concerning the character and strength of the "French presence" in each territory. And in addition to the general political background and administrative status of the three countries, the rise of local nationalism as a challenge to French control is of capital significance. Demographic, educational, and economic data also reveal much about the real impact of French rule.

Franco-North African affairs present a group of related problems. These include the following: the important role of the European and Jewish minorities, or French-North Africans; the question of government policy formulation and implementation in North Africa; the attitudes and influences of political parties, pressure groups, and the press of France with respect to policy on North Africa; and the general political challenge presented by the condition of Franco-North African relations as of mid-1954 and the formation of the Mendès-France government.

Three other aspects of North Africa's relations with the West require examination. First, is the inclusion of the three coastal departments of Algeria within the coverage of the Atlantic Pact and the association of Tunisia and especially Morocco with the Atlantic defense system. The significance of this NATO relationship in terms of western defense strategy has been underscored by the construction of powerful American air bases in Morocco.

Second, the involvements and attitudes of third parties, both inside and outside the Atlantic community, have a considerable impact upon the political evolution of North Africa. Concerning North Africa,

the actions and attitudes of Spain, Great Britain and The United States are particularly important and significantly affect the relations between these states and France.

Third, the extent to which North Africa has been incorporated into the plans and progress made toward European integration sheds further light upon the degree to which North Africa is or is not being pulled into the current of western political integration. Of marked importance, also, is the degree to which French political rule is or is not becoming in North Africa the agent of a European internationalism based upon principles of interdependence and mutual respect. This suggests the possibility of sublimating the present conflict between French and Arab nationalism within a broader community of partnership.

Summarizing the relations between the Islamic countries of North Africa and the Atlantic community leads to one basic conclusion. At least for the present, France is the determinant western influence in North Africa. But France has lost local political initiative to the North African nationalists. Yet numerous opportunities for action remain open to the French by which they might hope to regain the initiative and stand a better chance of effectively promoting a peaceful, profitable, and durable participation of North Africa within the Atlantic community in free association with the French Republic.

428 pages. \$5.35. MicA 55-1485

POLITICAL SCIENCE, PUBLIC ADMINISTRATION

FEDERAL RECLAMATION POLICY AND ADMINISTRATION: A CASE STUDY IN THE DEVELOPMENT OF NATURAL RESOURCES

(Publication No. 10,869)

Frederic Neill Cleaveland, Ph.D.
Princeton University, 1951

During the last fifty years there has been a steady growth of public interest in the conservation and utilization of natural resources. Population growth, industrial expansion, America's present role in world affairs, and many other factors have contributed a new urgency to the orderly development of our natural resources. At the same time few government activities have given rise to more complex political and administrative problems. To comprehend these problems and the evolution of conservation policy, it is essential to examine the close relationship of environment and administration.

The ecology of resource conservation in the United States is made up of a complex of interrelated factors. These conditioning factors include: (1) the physical unity of nature; (2) the political atmosphere of competing interest groups; (3) a physical technology dictating methods and rates of development; (4) a social

technology composed of such elements as complicated state water law and the dispersion of governmental and administrative authority for resource conservation among different levels of government and different executive agencies; and (5) the growing reliance of the American people upon collective action through government to attain their social, economic, and political objectives. Within such an environment federal policy and organization for reclaiming arid land have evolved over the past half-century, moving through two full cycles of alternating emphasis, first upon policy growth and then upon organizational change.

After primary reliance upon private and state action, federal responsibility for reclaiming arid western lands was finally crystallized in the Reclamation Act of 1902. For the next twenty years major emphasis was given to launching the construction program and perfecting the administrative organization. Then, attention shifted to the financial plight of project settlers, as the Bureau of Reclamation worked out its present policy of flexible repayment and selective relief. A new emphasis upon multiple-purpose planning also emerged from this second phase of policy growth. To meet the administrative problems posed by the expanded and more complex program, the Bureau was reorganized during the 1940s, shifting to a line and staff organization decentralized along regional lines.

The four functional branches - Project Planning, Design and Construction, Operation and Maintenance, and Power Utilization - reflect the major phases of the Bureau's work. In the first, or planning stage, the regional director initiates the planning investigation, usually in response to local and/or Congressional pressures. This planning phase includes preparation of the detailed project plan report and the almost endless process of review and criticism through which it passes before the final Congressional decision on authorization of the project. In the design-and-construction stage the Chief Engineer's staff and the regional office staff work together to accomplish elaboration of the project plan and careful programming of the job in terms of timing and the requirements of time and money. Construction contracts are let and administered by the Chief Engineer and the regional director concerned, according to a prearranged schedule.

Once completed, the project passes over to the operation and maintenance staff (O and M), which has already attended to land classification, crop planning, and the negotiation of repayment contracts with the water users. This staff is responsible for operating the project works and keeping them in good repair.

Hydroelectric power development is planned and worked out by a separate technical staff (Power Utilization). This staff participates in advance planning activities, advises on design and construction of power facilities, and is responsible for marketing the energy and operating and maintaining project power facilities.

In all this web of interrelated activities, the Commissioner and his three assistant commissioners direct the program through the seven regional

directors, who enjoy virtually full authority for operating decisions in all areas except design and construction. Branch and office heads in the Office of the Commissioner, with little authority over operating decisions, exert powerful influence on the program through technical guidance, review of project plans, annual budgets, and six-year program documents. The constant glare of public and Congressional attention to which the Bureau is subjected has tended to develop in the organization sensitivity to external opinion, skill in "political" techniques of building support, a strong urge for security, and some inclination toward institutional rigidity.

The evolution of federal reclamation policy and the experience of the Bureau reveal clearly the need for rational organization and unified national policy for promoting the development of water resources. A single, federal water-resource agency, decentralized along regional lines, is urgently needed. National water policies must be overhauled to yield a unified, comprehensive policy encompassing all possible purposes for which water resources may be developed. This policy must also be uniform for all water resource activities, emphasizing: (1) development through integrated, river-basin planning, (2) uniform standards for project evaluation, (3) a uniform requirement for substantial reimbursement of federal investment by project beneficiaries, and (4) the essential public interest in promoting family-sized farms.

316 pages. \$3.95. MicA 55-1486

THE PRESIDENT AND LABOR DISPUTES:
A CASE HISTORY OF EXECUTIVE INTERVENTION
IN RAILWAY LABOR RELATIONS

(Publication No. 10,882)

Robert Burns Dishman, Ph.D.
Princeton University, 1948

It is axiomatic that a free people will stay free only as long as they permit no private interest or power to challenge their own. Yet there is every indication that corporations and labor unions alike have concentrated in their hands more than enough power to deprive the public of an essential service of commodity except on terms that exploit to some degree their ability to withhold their services. In industries that are still highly competitive, of course, corporations have an interest in maintaining production that, fortunately for both, coincides with that of the public. In those other industries, however, in which one or a few corporations have a legal or de facto monopoly – public utilities, railroads, and some branches of manufacturing – there exists no such identity of interest.

Labor unions, on the other hand, seldom have such a stake in uninterrupted production. On the contrary, their ability to paralyze production by quitting in concert is their most effective means of seeing that their

members receive a fair share of the national product. The result has been that the public is frequently deprived of an essential service or commodity by the failure of labor and management to agree on the terms of employment. As industry becomes increasingly interdependent and society increasingly urbanized, moreover, the public is becoming more and more vulnerable even to the measures which labor may use legitimately to force its demands upon management. To protect its very safety and well-being, the public has turned to its governmental agents – the legislator, the judge, the administrator – and the President.

Every branch of government and every level is able to hasten or to influence settlement of labor disputes. None, however, is in a better position to do so than the President. His personal and official prestige is usually great, and his powers, necessarily somewhat indeterminate anyway, are usually both ample and available in case of emergency. The danger, in fact, is that in intervening he will act counter to a second (and usually secondary) interest of the public in seeing that justice is done both parties. These possibilities are nowhere better demonstrated than in his long record of almost continuous intervention in railroad labor disputes.

In its earliest phase presidential intervention was mainly military. In the three decades prior to the turn of the century railroad workers, like practically all others, were weakly organized, and they could be sure of making their withdrawal effective only by resorting to force and intimidation. Inevitably, therefore, strikers during this period were drawn into open and sometimes bloody conflict not only with the local and state authorities but occasionally even with the federal government. Twice within a generation – in 1877 and 1894 – Presidents were called upon to put down widespread railroad strikes that not only worked a hardship on the public but seemed to strike at the heart of orderly government. In each case the President's action redounded exclusively to the benefit of railway management.

As railroad workers, like most others, gained in power and cohesion, they no longer had to resort to illegal methods to make their withdrawals effective. The President, therefore, was forced to rely less on his military and other powers and more on his personal and official prestige to prevent and, if necessary, to cut short any large-scale suspension of railroad service. In the last forty years Presidents have had ample opportunity to develop a wide variety of techniques of intervention. Since 1906 the nation's railroads have been completely paralyzed once (1946), partially disrupted three times (1919, 1920 and 1922), and threatened with general strikes roughly every three to five years. Hardly without exception, no serious threat of a region- or nation-wide railroad strike has developed without making it necessary – in his judgment at least – for the President to intervene.

How effectively has the President been able to protect the public by his intervention in labor disputes? Like all other presidential activities, his intervention in labor disputes is largely personalized,

making it difficult to generalize on the matter. It is possible to say on the record so far, however, that the President is most apt to further sound public policy if he will:

(1) Limit his personal intervention to those relatively few disputes likely to dislocate or paralyse the national economy.

(2) Wait before intervening personally until both parties have exhausted all reasonable hope of reaching a peaceful settlement themselves or through the mediation of others.

(3) Limit his intervention if circumstances permit to supplementing and reinforcing the efforts of his subordinates to adjust the dispute.

(4) Refrain from influencing or dictating the terms of settlement until he is certain that in no other way can the parties be induced to make concessions to each other.

(5) Intervene impartially and decisively with all the powers legally at his command, if there is no other way to spare the public from being deprived of an essential service or commodity.

411 pages. \$5.14. MicA 55-1487

A GOVERNMENT OF MEN: AN ANALYSIS OF THE DISCRETIONARY POWERS DELEGATED TO THE EXECUTIVE

(Publication No. 11,900)

Moshe Eliash, Ph.D.
Cornell University, 1955

All Government is a government of men, in the sense that it must respond to the needs and demands of the men for whom it is constituted. New needs and new demands of government will therefore result in change in the nature of political institutions.

This study aims to analyse the changes in the nature of the function of the executive resulting from the rise of the welfare state. Secondly, it proposes to discover the nature of the basic limitations placed on the exercise of discretionary duties by the executive.

Chapter II analysed the position of the executive in the constitutional framework as originally conceived, and traced the early developments in the nature of the duties discharged by the executive. Chapter III pointed out the change in the conception of government, and of liberty, characteristic of our time. It emphasized the fact that whereas in the Eighteenth Century government was thought of as negative, we now tend to expect government to act in a positive manner for the preservation of liberty. Whereas rights were conceived of then exclusively as individual rights, enjoyed against government, we now include communal rights in the concept, rights enjoyed only through government. The result is a new expectation of what government should do. One main result of the consequent rise in government activity was shown to be the emergence of the executive as the leading branch in the government. The reasons

for entrusting the executive with a vast range of discretionary powers was then analysed.

Chapter IV turned to an examination of the checks placed on the executive. It began by analysing the nature of the functions discharged by the three branches under modern conditions. It then analysed the nature of the duties of the executive. It proved that the discretionary powers delegated to the executive emerged as a homogeneous group. Their purpose is to protect the public rights, the new rights which are protected by government.

In the protection of public rights, the main danger is that of infringing private rights, rights of individuals. These rights, it was shown, were given to the courts to administer. Chapter V therefore turned to an analysis of the position of the courts vis-a-vis the executive. It was shown that the courts are, at least in theory, in a position to determine their relationship to the executive as they see fit. They are in a position to impose what restrictions they wish on the exercise of discretionary powers by the executive. Yet, it was shown, this power was exercised with restraint, revealing judicial concern with the preservation of certain fundamental principles.

The philosophy involved in judicial delineation of the scope of review over administrative action was analysed in Chapters Six and Seven. It was there shown that the standards imposed by the courts are all concerned with one purpose. That purpose is the protection of the individual and his rights from unwarranted interference by the executive. In the exercise of this power the courts are in a strong position, for it is the courts who decide what is an unwarranted interference with individual rights.

The rise of discretionary power in the executive, it is therefore concluded, was fitted into the constitutional conception of a separation of powers. The division of the protection of private rights and of the protection of public rights, between the judiciary and the executive, ensures that checks and balances will be maintained. Our government while a government of men, still remains a government of laws.

307 pages. \$3.84. MicA 55-1488

OPERATIONAL ASPECTS OF THE SENATE JUDICIARY COMMITTEE: A STUDY OF COMMITTEE PROCEDURE 1923-1947, WITH SPECIAL REFERENCE TO THE CONGRESSIONAL REORGANIZATION ACT OF 1946

(Publication No. 10,893)

David Gregg Farrelly, Ph.D.
Princeton University, 1949

It is the purpose of this dissertation to trace the institutional development of the Senate Judiciary Committee, and to examine in detail the operational practices and policies of the last quarter-century.

The combination of broad jurisdiction, a consistently heavy agenda, and several unique functions, has given the Committee on the Judiciary a superior

position among committees of the United States Senate. Since its creation in 1816, membership has been reserved exclusively for lawyers. The roster has included the names of outstanding jurists, and in terms of professional experience members have been well qualified for service. While responsibility for courts and the administration of justice has constituted the nucleus of its work, the committee is noteworthy for having an extensive jurisdiction which includes a wide variety of subjects. One of its chief functions has been to serve as constitutional advisor and legal counsel to the Senate. Since the Civil War the committee has played a significant role in the amending process and in screening judicial appointments.

In the years from 1923 to 1947, the committee has exhibited manifold operational characteristics. Investigation of the committee workings reveals these practices and policies, and the intricacies of committee management.

The committee's business is conducted in a bi-partisan setting. Despite a key position, chairmen have not exerted a predominating influence. Not only is the bi-partisan tradition strong, but most chairmen have been disinclined to arbitrariness. In the last decade formal rules have been developed to standardize procedures and restrict the chairman's freedom. Furthermore, as committee administrator, the chairman's discretion is limited by convention, circumscribed by a variety of senatorial courtesies, and hedged in by practicalities. In the appointment of subcommittees the difficulties and complexities of management are especially evident; shrewdness and good judgment are required to extract the best work from the membership.

Dealings with the House Judiciary Committee, the Justice Department, and the organized bar have featured in the committee's operations. Informal contact with the House Judiciary Committee has resulted in preferential treatment for House bills and the mortality rate has been less than on Senate measures. Time and energy have sometimes been saved by adopting hearings and reports of the House Judiciary Committee, but in the interest of congressional efficiency much more can be done to avoid duplication of effort.

Effective liaison with the Justice Department has varied considerably from Congress to Congress, but there has always been a need for mutual understanding and cooperation. In exchange for introducing Justice legislation, the committee solicits information and advice, and uses the Department as a clearing-house. Departmental opinion is seldom forthcoming, however, on constitutional questions or on measures concerning broad public policy.

Unlike the Department of Justice, the legal profession has lacked effective machinery for acquainting the committee with its viewpoint. Coupled with the unsympathetic attitude of many committeemen, the bar has not exerted great influence on committee decisions. Only on provincial judicial legislation have opinions been important. During 1947 Chairman Alexander Wiley was rather successful in encouraging bar associations to assist the committee, particularly on Executive nominations to judgeships.

Handling Executive nominations is the committee's most distinctive function. Because of its key position in the confirmation process, it has sometimes been able to extend its influence into the pre-nomination stage and thus influence the selection of candidates. Ordinarily, however, the committee is concerned only with confirmatory duties. Procedures have been standardized of late and are unique. Referral of judicial nominations to subcommittees is now automatic, as are routine hearings. Yet, as illustrated by its treatment of Supreme Court appointments, the committee has not placed itself in a procedural straitjacket. By far its most significant task is to act as an enforcing agency for the Senatorial Courtesy rule. And the constant problem is that of securing unbiased information with which to counterbalance the persistently favorable reports supplied by the Department of Justice.

In 1947 the impact of the Congressional Reorganization Act sharply affected the workings of the committee. The four-fold increase in its business included a swarm of private bills. To meet new problems with a cramped personnel situation, two-man subcommittees were utilized, and permanent subcommittees created for specialization. More efficient methods of processing legislation were developed, and liaison with the Justice Department improved. New subject matter was assimilated with a minimum of confusion, yet with caution and due regard to future committee policy. By diligent concern for administrative efficiency and with the assistance of a professional staff, an amazing record was set in reaching decision on forty per cent of its swollen legislative agenda.

314 pages. \$3.93. MicA 55-1489

THE COLUMBIA RIVER BASIN AND THE COLUMBIA BASIN JOINT INVESTIGATIONS WITH SPECIAL REFERENCE TO PROBLEM 12

(Publication No. 12,136)

Lloyd William Schram, Ph.D.
University of Washington, 1955

The Columbia River Basin presents an unparalleled opportunity for the systematic development of a great national resource. The largest multiple purpose project of the Basin is Grand Coulee Dam which, among other things, has made possible the irrigation of approximately 1,200,000 acres of land within an area of roughly four thousand square miles in south-central Washington. This is the Columbia Basin Project Area.

The Columbia Basin Joint Investigations, consisting of twenty-eight separate problems outlined by the Bureau of Reclamation, Department of Interior, constitute a general comprehensive design for the development of the area. Problem 12 of these investigations asks how payments toward the cost of the primary irrigation works might be secured from the non-rural settlers.

The existence of three large irrigation districts

encompassing virtually the entire area necessitates their consideration as agencies for the collection of such payments. However, incorporated areas have been excluded from their boundaries and present law would require the unrealistic expedient of a petition by the landowners for the inclusion of non-farm lands. The most equitable and effective means of including new lands within the districts would be by direct legislative action with provisions for the exclusion of certain classes of non-benefited lands.

Judicial decisions and treatises make it clear that the state legislature has the power to alter the boundaries of a public corporation such as an irrigation district without the notice and hearing which might otherwise be necessitated by the requirement of "due process."

The state constitutional requirement of a general law could undoubtedly be satisfied by a classification of the districts in terms of size and the reasonableness thereof would be predicated on the common dependence upon a water supply and the indirect benefits resulting from the development of the area.

The general rule that two municipal corporations cannot occupy the same territory would not preclude the inclusion of lands of other small irrigation districts within the large districts inasmuch as the state supreme court has held that irrigation districts are not municipal corporations in this sense.

The problem as to the form of payment essentially involves a consideration of the ad valorem tax and the special assessment. The constitutional 40 mill levy limit and the requirement of uniformity virtually negate the utility of the ad valorem tax. The special assessment is not subject to these limitations and could be levied on an ad valorem basis by the irrigation district boards. The problem of a delegation of legislative power could be met by the legislative provision of suitable standards for the guidance of the boards. Notice and hearing would be mandatory.

As Problem 12 potentials, however, the irrigation districts pose difficulties. It would be necessary to make adequate provision to obviate the lack of uniformity resulting from assessments by three separate boards. Also, the admission of new landowners within a district presents a problem under "due process" in relation to possible vested rights of the original landowners in the assets of the district. Finally, if the new members were granted voting rights accorded by existing law they could maintain a strong control over the irrigation district boards.

A special district created by the legislature utilizing existing county offices effectively could levy special assessments and avoid the difficulties presented in utilization of the existing irrigation districts.

171 pages. \$2.14. MicA 55-1490

PSYCHOLOGY

PSYCHOLOGY, GENERAL

- AN INQUIRY CONCERNING THE EFFECTS
OF ANCHORING POINTS UPON JUDGMENT:
I. THE EFFECT OF REMOTE ANCHORING POINTS
UPON THE JUDGMENT OF LIFTED WEIGHTS.
II. IMMEDIATE VERSUS PRE-ESTABLISHED
FRAMES OF REFERENCE IN
THE JUDGMENT OF ATTITUDINAL STIMULI.

(Publication No. 10,919)

Roy Karl Heintz, Ph.D.
Princeton University, 1947

An experiment was undertaken to observe the effect of remote anchoring points upon the judgment of weights, in order to secure additional data pertaining to the functioning of frames of reference. Subjects were given preliminary training in judging a series of five (standard) weights, viz., 84, 88, 92, 96, and 100 grams, on a scale graded from 'one' to 'five', lightest to heaviest, respectively. Following this a series of anchoring points (heavier weights) were introduced, in a regular ascending order, ranging from 100, 104, and 108 grams, etc., to 164 grams, inclusive.

Mean judgment values were computed for each

stimulus. Values for the several standard stimuli dropped progressively as more and more remote anchoring points were introduced. While the functions were complex, no evidence of discontinuity was seen. Rather, the results appeared to display a degree of variability common to psychophysical investigations. These findings were compared with those of Rogers, who concluded that the effect of anchoring was a rectilinear function of the remoteness of the anchoring stimulus up to a point, where a break in the functions appeared, followed by a diversity of trends. This lack of agreement was discussed in relation to the use of regression lines, and in relation to the limitations inherent in one type of statistical approach.

A second experiment was undertaken to observe the effect of anchoring points upon initial reactions to verbal materials. Eight sets of scaled statements were drawn from two Thurstone attitude scales (concerning the Negro, and the punishment of criminals). Sets were distributed to a control group and three experimental groups. Three favorable statements from each scale were presented as standard stimuli. Three unfavorable statements from each scale were used as anchoring points. Subjects were asked to rate the statements on a scale ranging from 0 to 10, extremely unfavorable to extremely favorable, respectively.

Mean judgment values for the three standard statements for the three experimental groups were not significantly different from those for the control group. There was no appreciable difference in results for the three experimental groups to reflect the three degrees of remoteness of the anchoring stimuli. The experimental alteration of immediate frames thus had little or no effect upon judgment. These results were compared to those of McGarvey. Two differences in procedure were noted in connection with the observed differences.

In contrast to the observed lack of differences as a function of immediately given frames, judgments varied consistently as a function of pre-established frames. Subjects with favorable frames of reference tended to judge favorable statements more favorably, and to judge unfavorable statements more unfavorably, than did entire groups of subjects. Subjects with unfavorable frames tended to judge favorable statements less favorably, and unfavorable statements less unfavorably. Median ratios showed that the alterations in judgment associated with differences in pre-established frames were 1.39, 1.81, 3.20, and 3.56 times as great as the changes in judgment associated with alterations in immediate frames.

Results indicate that (1) frames of reference do not operate discontinuously. (2) Subjects will tend to judge complex, emotionally-toned verbal stimuli upon the basis of immediately given frames, if allowed to judge freely, without special instructions.

125 pages. \$1.56. MicA 55-1491

AN EXPERIMENTAL STUDY OF THE SZONDI TEST STIMULI

(Publication No. 11,941)

Arthur Lefford, Ph.D.
New York University, 1954

Adviser: Thomas N. Jenkins

An experiment was conducted in which eighty subjects judged the Szondi pictures for the traits attributed to them by Szondi and Deri. A ranking method was used in which the eight pictures of a Szondi group were ranked for traits descriptive of the eight Szondi factors. Each of the six Szondi groups was judged for each of the eight descriptions of the Szondi factors. The eighty subjects who acted as judges comprised forty patients of a mental hospital and forty non-hospital subjects.

The results indicated that only twelve of the forty-eight Szondi pictures were ranked highest for the traits attributed to them by Szondi and Deri. Analysis of the variability of the judgments indicated that very many of the pictures did convey certain reliable phenomenological impressions of personality albeit not those ascribed to them by Szondi and Deri. The rankings given to the pictures by the hospital sample were not significantly different from those of the non-hospital subjects.

Analysis of the results revealed that inter-subject agreement in ranking was low, while inter-group agreement was high. These findings were compared to similar findings in psychophysical and esthetic judgments. The similarity of the functions suggested that the judgmental processes underlying the perception of physiognomic attributes is the same as that found in psychophysics and esthetics.

Deri's identification rationale for the preferences of physiognomic attributes and a need-press rationale, based on Murray's theory, were evaluated in view of the empirically determined phenomenological meaning of the Szondi factors. Neither of the alternative rationales was found to be compatible with the stimulus values of all the Szondi factors. However, the identification rationale was supported by only three factors while the need-press rationale was supported in six factors. Two factors were unaccountable by either rationale.

When a group of control pictures were judged for the traits descriptive of the Szondi factors, it was found that they produce reliable impressions of personality. It was concluded, therefore, that the pictures of mentally disturbed persons, used by Szondi, appear to offer no special advantage over pictures of normal persons in conveying phenomenological impressions of personality.

Individual and group differences in judgment were examined under sixteen standardized stimulus conditions defined by the six pictures highest and the six pictures lowest in eight traits. Individual differences in terms of good and poor judges, and over- and under-estimators were found. It was also found that the hospital group significantly under-estimates anal and depressive traits in pictures high in these traits, and significantly underestimates positive super-ego traits in stimuli that are low in these traits.

In a final critique of the Szondi test, it was argued that the test can be considered as a test of object cathexis, comparable to conventional preference questionnaires. The pictures may be considered as items of low face validity, and the Szondi factors as sub-tests measuring different traits. Preferences and aversions for the pictures, or items, are considered as reflecting individual differences. Evaluated from this point of view, it was concluded that the stimulus values of the Szondi factors are in need of sharper differentiation. Homogeneity among the items in the same category is also very poor, which may lead to spurious scores. In its present state, the Szondi test would appear to be a crude psychometric instrument. However, as a prototype test of object cathexis, it combines certain advantages of the projective techniques and the more conventional tests of preferences: it presents the testee with an apparently ambiguous test situation, but permits standardized administration and scoring, and psychometric refinement.

These conclusions, however, do not unequivocally bear on the clinical validity of the test since the clinical use of the test is based on conative judgments. This study has rather primarily dealt with certain cognitive assumptions advanced by Szondi and Deri as a theoretical rationale for the test.

154 pages. \$1.93. MicA 55-1492

THE PREDICTION OF A CRITERION OF FLIGHT SAFETY IN NAVAL AVIATION

(Publication No. 12,088)

James Fletcher Parker, Jr., Ph.D.
University of Maryland, 1955

Supervisor: Professor Ray C. Hackman

This study was designed to investigate differential accident liability among Naval flight personnel. A number of studies in industry have indicated that in any given work group some individuals contribute disproportionately to the total number of accidents. This study evaluated one means of identifying such individuals in aviation. In addition, the following variables were investigated in terms of their relationship to a pilot's placement on continua of safeness and skill as a pilot: (1) attitudes toward various aspects of Naval flying, (2) the galvanic skin response of a pilot as he is presented with the same item of flight safety procedure.

Ninety pilots assigned to a U. S. Navy aircraft carrier were used as subjects in this study. These pilots evaluated by means of "peer ratings" the other members of their squadron both as to safeness and skill. A criterion of accident liability derived from these ratings was found to possess certain advantages over other criteria. The peer ratings were easily obtained, were reliable, and could be predicted by each of the independent variables used in this study.

Multiple regression analyses indicated that major differences exist between low ranking and high ranking officer groups with respect to the manner in which the above variables are related to the criteria. Such differences may be a function of greater experience in flying on the part of the high ranking officers. For predicting relative safety and skill, multiple correlation coefficients were obtained ranging from .48 to .68. All were significant at the .01 level of confidence.

Since the criteria of a good pilot are that he be both safe and skillful, a canonical correlational analysis was made to determine the efficiency with which a pilot could be placed on both continua simultaneously. A coefficient of .58 was obtained for the Ensign group and .74 for the higher ranking officer group.

On the basis of this study, the use of peer rating procedures as a means of establishing criteria of differential accident liability is recommended.

Measures of attitudes toward aspects of Naval aviation; judgmental evaluations of flight safety procedures; and measures of galvanic skin responses accompanying the viewing of items of flight safety procedure are demonstrated to be effective predictors of both the flight safety and skill criteria.

114 pages. \$1.43. MicA 55-1493

PSYCHOLOGY, CLINICAL

SOME QUANTITATIVE PROPERTIES OF VERBAL BEHAVIOR IN PSYCHOTHERAPY

(Publication No. 11,960)

Bernard Seymour Aaronson, Ph.D.
University of Minnesota, 1955

The results of a functional analysis of verbal behavior under conditions of stress and of difficulty in obtaining reinforcement were applied to patient speech in psychotherapy. It was postulated that the diversity of words emitted should vary directly with pressure to obtain responses from the therapist, inversely with stress, and should show a general tendency to increase as psychotherapy proceeds. The frequency of long words was assumed to increase as diversity increases and as stress is eliminated. The distribution of intervals between successive occurrences of the same response was assumed to shift in the direction of greater frequency of larger intervals as stress is eliminated and pressure to obtain responses increases.

A running count of the first 2,000 words emitted by the patient in each successive interview of four cases of nondirective therapy was made. For each of these samples, the Discomfort-Relief Quotient was calculated as a measure of stress, a content analysis procedure was used to assess pressure to obtain responses, the diversity of words used was determined by means of Yule's coefficient, K , the interval-frequency relationship was calculated as prescribed by Zipf, and the total number of occurrences of words of four syllables and more was tabulated. The methodology used was that of P-technique, and the variables were compared with respect to their interrelationships with one another and with time. The statistics employed were almost entirely nonparametric and included analyses of variance of ranks, rank correlations, sign - and runs - tests, and the absolute distance method of Osgood and Suci.

As compared with one another, the cases showed significant distances with respect to pressure to obtain responses, word-complexity and diversity. Examination of the modes of variation of the several variables in each case suggested a distinction between states, which were defined as syndromes of response relationships, and strategies, which were regarded as patterns of responses designed to procure some particular kind of reinforcement. To the extent that any specific kind of behavior was a component in a strategy it seemed to be controlled by the strategy and become less representative of the state. Of the variables employed in this study, word complexity seemed most related to DRQ, the indicator of the state of stress, and interval frequency seemed most related to the strategy of pressure for responses. While diversity of words used seemed more related to response pressure than to stress, it tended to be more under control of both of these measures than either word complexity or interval frequency.

The data also suggested an inverse relationship between the frequency of long words and stress and a

positive relationship between long word frequencies and diversity of words used. Diversity seemed to increase over the course of therapy regardless of whether the amount of stress seemed to decline or not. A suggestion that a rapid increase in pressure to obtain responses seemed associated with quitting therapy was made. It was pointed out that this study was in the nature of a first attempt to crystallize out a few variables from a highly complicated situation. Further studies with regard to both patient and therapist speech are needed before any full account of verbal behavior in the psychotherapeutic situation may be given. 193 pages. \$2.41. MicA 55-1494

**PRELIMINARY VALIDATION OF A
STANDARD PERSONAL HISTORY
FOR PSYCHIATRIC DIAGNOSIS**

(Publication No. 11,965)

Peter Farkasch Briggs, Ph.D.
University of Minnesota, 1955

Adviser: William Schofield,

This study describes the construction and interpretation of a standard history questionnaire. The questionnaire was designed to be given to the informant of any adult male psychiatric patient. There are 175 ratings in the questionnaire. The first 132 of these record history material which is unrelated to marriage. The last 43 items apply only to facts in the histories of married patients. When compared to the routine psychiatric history, the questionnaire has been found to contain about three times as much information with only a few omissions.

Eight clinicians were given the questionnaire along with a list of 22 semi-diagnostic psychiatric terms. From this list, 12 terms were selected as well represented in the questionnaire and specifically pertinent to the history. For each of this latter set of twelve terms the eight clinicians were asked to select items from the questionnaire which suggested or defined the term in question. The judges were able to agree among themselves on the items for eight of the terms. These were "Psychopathic Personality," "Failure-Achievement Pattern," "Hypochondriasis," "Unstable Unrewarding Home," "Neurotic Diagnosis," "Conflict with Parents," "Schizoid Personality" and "Poor Unrewarding Social Relations."

The questionnaire itself was given to the informants of 133 hospitalized psychiatric patients. From this pool of responses, 100 questionnaires were selected on the basis of completeness and other aspects of validity. The final sample of patients contained 85 psychotics, 5 neurotics and 15 behavior disorders.

The eight item sets defining the semi-diagnostic concepts were evaluated using the 100 cases. For each item response in the questionnaire the McCall T-scores were calculated. The item sets provided by the clinical judges were then scored by adding the T-score values for the questions in the set.

Cronbach's alpha coefficient was then calculated for each set.

The item sets defining the concepts "Psychopathic Personality" and "Failure-Achievement Pattern" appear to be especially good. For these two concepts the alpha values are between .70 and .80. The items defining "Hypochondriasis," "Unstable Unrewarding Home," "Neurotic Diagnosis" and "Conflict with Parents" have alpha values in the .60 and .70 range. For only two concepts, "Schizoid Personality" and "Poor Unrewarding Social Relations," were obtained alpha values less than .60.

Two conclusions are suggested by this research. First, this questionnaire, when used as a method of collecting the history data, appears to be efficient for both research and clinical usage. Second, clinicians have been able to select item sets which are sufficiently homogeneous to be considered measures of the concepts they are supposed to define.

119 pages. \$1.49. MicA 55-1495

**THE RELATIONSHIP OF INDIVIDUAL
AND HUSBAND-WIFE PATTERNS OF
PERSONALITY CHARACTERISTICS TO
MARITAL STABILITY**

(Publication No. 12,127)

Philip McClellan Carman, Ph.D.
University of Washington, 1955

Past research designed to assess the relationship of personality factors to marital adjustment has the weakness that the scales used to measure personality characteristics and those used to measure marital adjustment are vulnerable to subject bias, or the tendency of some persons to describe themselves in socially acceptable ways. Consequently, the correlations between the marital adjustment and personality measures may be spurious if it is true that the two types of measures are measuring individual differences in conservatism and conventionality. In addition, very little research has shown the relationship to marital adjustment of husband-wife patterns in personality characteristics, even though there is a large amount of theorizing and speculating in the literature concerning this problem.

The purpose of this study was to investigate the relationship to marital stability of individual and husband-wife patterns of personality characteristics in a single experiment in which the measures used to assess personality factors are less vulnerable to subject bias and in which a behavioral criterion for marital stability is used in the place of a marital adjustment scale. The basic research design involved the comparison of a group of divorced and married subjects with respect to their scores on the Kuder Preference Record and Edward's Personal Preference Schedule. The divorced group comprised eight divorced couples, eight additional divorced males and twelve additional divorced females. The married group comprised twenty married couples. Approximately three-fourths of all subjects took the

two tests a second time with special instructions to answer the test items the way they believed their spouses or ex-spouses would do.

The individual personality scores and the husband-wife difference scores were compared for the two groups of subjects by means of *t* tests. The results of these comparisons constitute more reliable evidence concerning the importance of individual personality characteristics for marital stability than they do concerning the importance of husband-wife patterns. Also, the comparisons of the divorced and married subjects in terms of individual personality scores yielded more reliable differences for men than for women. To this extent the results are consistent with those of previous studies. However, there appeared to be some meaningful differences in the results on the two tests. Slightly more differences appeared on the personality need test than on the interest test. Also, the need test scales tended to show a different relationship to marital stability for men than for women.

125 pages. \$1.56. Mic 55-148

THE GENERALITY OF SELF CONSTRUCTS

(Publication No. 12,027)

Edward Gilbert Goodrich, Ph.D.
The Ohio State University, 1954

Adviser: George A. Kelly

This study was derived from George A. Kelly's recently formulated theory known as the psychology of personal constructs. At its most general level the problem was whether constructs which are elicited in a self-characterization are likely to appear in a form of Kelly's Role Construct Repertory Test (referred to as RCRT).

Constructs are dichotomous frames of reference which people project upon the world of reality. They are ways in which some events are seen as alike, yet different from others. Construing, then, involves a simultaneous abstraction of a likeness and a difference.

The modified RCRT used in this study consisted of a grid with nineteen columns and twenty rows. Names of specific people who were suggested to the subjects by general role descriptions headed each column. The first column represented the self. The subjects were required to consider each row, form a construct on the three people whose names had circles under them, write both ends of the construct to the right of the row, and then check all the people to whom the likeness end of the construct applied.

The likeness and contrast terms are not considered to be the constructs but merely the cognitive counterparts of the sorting procedure. Operations for the constructs are provided by the pattern of checks and blanks in each row.

One part of the RCRT required the subjects to form constructs on figures other than the self.

Another part required subjects to form constructs on the self and two other figures.

Undergraduate students were asked to write intimate yet sympathetic character sketches of themselves in the third person. Judges selected one construct from each protocol which seemed to contain the essence of the subject's self-identity.

Each subject was randomly assigned some other subject's self-characterization construct.

After each subject completed the RCRT, the experimenter added each subject's own self-characterization construct and his randomly assigned self-characterization construct to the bottom of the grid. The subject was asked to check all the people to whom the likeness ends of the respective constructs applied.

Each RCRT grid was factor analyzed with a non-parametric technique to obtain a generalized construct factor. This factor, like the individual RCRT rows, was a pattern of checks and blanks. The degree of correspondence between this factor and each of the two appended constructs was determined by counting the matchings of checks and blanks.

The mean match of each of the appended constructs with all RCRT constructs was determined. This was compared with the mean match of RCRT constructs with one another.

The highly simplified hypotheses appear as follows:

1. Self-characterization constructs have a better than chance relationship to RCRT constructs. Random self-characterization constructs do not.
2. Self-characterization constructs have a greater relationship to self RCRT constructs than to non-self RCRT constructs.

In addition to comparing constructs with one another, it was also possible to measure the perceived relationship between the self and other RCRT figures:

1. The self is more similar to the other RCRT figures than they are to one another.
2. The self is more similar to parent figures than to non-parent figures.

Conclusions:

1. Constructs which are elicited by a self-characterization have generality at least with respect to a form of Kelly's RCRT.
2. A person's self-identifying constructs are highly similar to those constructs with which he abstracts the presumed thinking of others.
3. Constructs which are formed on the self and then applied to others are no different from those which are formed on others and then applied to the self.
4. The degree of perceived similarity between self and others is not as great as the perceived similarity among others.
5. College students see themselves more like their parents than like non-parents.

182 pages. \$2.28. MicA 55-1496

**A COMPARISON OF ACTUARIAL VERSUS
CLINICAL PREDICTION TO CLASSES
DISCRIMINATED BY THE MINNESOTA
MULTIPHASIC PERSONALITY INVENTORY**

(Publication No. 11,979)

Charles Carson Halbower, Ph.D.
University of Minnesota, 1955

Major Adviser: Paul E. Meehl

The Minnesota Multiphasic Personality Inventory (MMPI) was used to classify white, male, veteran, psychiatric patients into four classes according to specifically defined characteristics of their MMPI profiles. The relative accuracy of two methods of prediction to a criterion was evaluated. The actuarial method was defined as the mechanical combination of information and the mechanical application of this combination of information as a prediction to a specified class of events. The clinical method was defined as involving any non-mechanical method of combining information and the use of clinical judgments in the emission of prediction responses. The definitions of these two methods did not restrict them as to the source or kind of information employed in generating the predictions. The domain of information predicted by these methods concerned behavior differentially associated with various aspects of the MMPI.

The predictions were made via a 154-item Q-sort. A wide variety of both general and specific personality characteristics were sorted according to their relative descriptiveness of a particular patient. Q-sort descriptions were obtained of a random sample of nine V.A. Mental Hygiene Clinic patients who had been seen for at least four hours of psychotherapy, whose MMPI profiles met the qualifications of one of the four classes, and whose case folders contained at least an average amount of information, or whose therapist was still available for doing a Q-sort. The actuarial predictions to each of the four criterion descriptions were made from an average of the five Q-sorts (out of nine) which demonstrated the highest intercorrelations. Information used in making these sorts included therapists' notes, psychiatric intake reports, social service intake reports, records of any previous therapeutic contacts, and, in most cases, the psychological report. The patient's MMPI profile was not used in making these sorts. The information mechanically combined in these "average" Q-sorts can be mechanically applied as predictions of the behavior of certain specified classes of people which can be identified by a clerical worker.

The clinical predictions were Q-sorts of "how the criterion patient would be described by a psychotherapist who knew him well." The information upon which these clinical predictions were based included the criterion patient's MMPI profile plus information regarding his age, education, marital status, occupation, and the fact that he was a psychiatric patient. The clinicians organized and evaluated this information any way they saw fit in making the predictions. Clinicians sophisticated in the use of the MMPI and

with different levels of training and experience made these predictions.

The criterion for each of the four MMPI classified groups was a Q-sort description of a number of psychological characteristics of a patient by his psychotherapist who had seen him for at least ten hours of psychotherapy. Each criterion patient was randomly selected from the class of patients obtaining very similar MMPI profiles. Information available to the criterion sorters included their memories of the therapeutic interactions plus all of the folder data used in the actuarial Q-sorts.

It was hypothesized that the actuarial predictions would correlate higher with the criterion descriptions than would the clinical predictions. This hypothesis was confirmed by three different significance tests. The experiment was replicated in a V.A. Psychiatric Hospital using a different sample of criterion patients, different criterion sorters (psychotherapists), and different clinical predictors, but the same MMPI characteristics were used to define the four classes and consequently the same actuarial prediction descriptions were used. Again, every actuarial prediction correlated higher with the criterion description than did any of the corresponding clinical predictions. The pattern of results which confirms the central hypothesis would occur by chance less than two times in 100,000.

178 pages. \$2.23. Mic 55-149

**EMOTIONAL ASPECTS OF PREGNANCY:
AN INTENSIVE STUDY OF FOURTEEN
NORMAL PRIMIPARAE**

(Publication No. 12,057)

Eleanor Hamilton, Ph.D.
Columbia University, 1955

Professional people who work with prospective mothers have become increasingly aware of the need these women have for emotional understanding and support. This intensive study of fourteen normal primiparae was undertaken for the purpose of gaining information concerning the emotions of women during a first pregnancy and concerning the interplay of emotion and other circumstances in the past and present lives of women who are going through the experience of giving birth to a child.

Each prospective mother was interviewed frequently and encouraged to share her feelings with the researcher. Eight of the women, in addition to being interviewed, were accompanied by the researcher throughout labor and delivery, and stenographic records were made of what they said and did and heard.

The areas of experience that were explored included the following: fear; superstition; intellectual life; attitudes toward the doctor; dreams; sex; nausea; food cravings; family and social relationships; anticipation of labor; feelings in labor and delivery; breast-feeding; reactions to hospital care.

Findings are too numerous to summarize in full,

so only a few of the more important outcomes are here reviewed:

Thirteen women reported fear and anxiety during pregnancy. The fears most commonly focussed on the possible loss or malformation of the child, or on delivery, or on the unknown. The women apparently suffering from obsessive fear also tended to reveal conscious guilt feelings, or anxiety with regard to sex or to report that the pregnancy was unwanted. An opportunity to unburden guilt feelings seemed to influence favorably the physical course of several pregnancies.

Some women experienced what seemed to them a slowing-down of intellectual life. This appeared to bother those who had previously valued intellectual pursuits.

Content of dreams reflected preoccupation with the hopes and anxieties of pregnancy.

There appeared to be no change in basic sexual adjustment during pregnancy. The women who reported good sexual adjustment also tended during pregnancy, to experience moods of elation, to continue some form of sexual expression, to be free from obsessive fear, nausea, or persistent food cravings; to desire the husband near during labor, and to experience pleasure in breast-feeding.

The women who breast-fed successfully tended to be those who, throughout pregnancy, had stated unqualified desire to breast-feed, had enjoyed emotional support from their husbands, were relatively free from anxiety about sex, had retained no childhood memories of traumatic toilet training or traumatic interference with genital play, and who already had an outgoing and giving attitude toward children.

Emotional support – particularly from the husband, was valued by every woman in the study, and, in its absence, emotional disturbance was expressed.

Most of these prospective mothers enjoyed foetal movement. The two who did not considered themselves sexually frigid. The fact that these conditions were associated is possibly of some significance.

When anticipating labor, twelve women spoke of the problem of pain and desired relief, should it become unbearable. Only two, however, discussed this problem with their doctors.

Women who expressed fear during labor, did so in response to specific stimuli.

When confronted with severe pain, no woman showed symptoms of what might be interpreted as masochism.

Morose philosophising during labor was indulged in only by the women who said they had not wanted their pregnancies.

There was strong reaction to the personality of the doctor and an expressed desire for the presence of someone trusted throughout labor.

Major objections to hospital care included: fatiguing routines, bed-pan schedules, separation of mothers from babies, exclusion of husbands, hearing women screaming in labor, inconsiderate handling of babies, negative attitudes toward breast-feeding.

The findings underscore the importance of a program during pregnancy aimed toward helping the prospective mother

- a) to express her fears,

- b) to lessen her anxiety about sex,
- and c) to provide her with emotional support and a definite and positive training for childbirth.

387 pages. \$4.84. Mic 55-150

PROTECTIVE MECHANISMS UTILIZED IN REACTION TO EGO-THREATENING SITUATIONS, AS EVIDENCED BY PERFORMANCE ON A LEVEL OF ASPIRATION PROBLEM

(Publication No. 11,935)

Myron Willard Harris, Ph.D.
New York University, 1954

Adviser: Dr. Joseph V. Hanna

STATEMENT OF THE PROBLEM

This study was directed toward investigating the hypothesis that the behavior of an individual when faced with failure in a level of aspiration situation has as its motive the protection of the individual against feelings of frustration or inadequacy. Thus the performances of subjects in two areas, level of aspiration and reaction-to-frustration, were observed and compared for similar characteristics.

SUBJECTS

Sixty white males, New York City college students, aged 18 to 30, of normal intelligence and emotional stability were examined.

INSTRUMENTS

1. The Number Square Test, by David Wechsler
2. The Level of Aspiration Board, by Julian Rotter
3. The Picture Frustration Study by Saul Rosenzweig
4. The Questionnaire of Blame Direction, by the writer
5. The Puzzle Situations, adapted by the writer
6. The Cornell Index, Form N.

PROCEDURE

The performance of each subject on all tests in the battery was studied on the basis of pre-determined variables. The resultant data provided eighteen variables in the level of aspiration situations (comprised of tests 1 and 2 above,) fourteen in the reaction-to-frustration situations (tests 3, 4 and 5) and one variable from the screening instrument (test 6). The relationships between the variables derived from tests 1 and 2 and those derived from tests 3, 4, 5 and 6 were subjected to statistical analysis by the following methods:

- a. Pearson product-moment coefficient;
- b. Chi-square coefficient of contingency;
- c. Point biserial r correlation;
- d. Pattern analysis;
- e. Individual test analysis

A statistical comparison of the tests within each of the two situational categories was also derived.

RESULTS

1. Performances of individuals on the two level of aspiration tests utilized were congruent with respect to three of the variables measured, but dissimilar in the cases of the remaining six variables.

2. Performances on the three reaction-to-frustration tests were not congruent.

3. Statistically significant relationships between level of aspiration variables and reaction-to-frustration variables were present only in small numbers; in light of the limited degree and extent of the relationships, the greater part of the data derived therefrom were not considered in the formation of conclusions.

4. Analyses of performances of each subject on the battery of tests showed the following similarity of functioning on the Number Square Test and the Picture Frustration Study: individuals who, on the former tended to avoid encountering failure by consistently maintaining a level of aspiration below prior performance demonstrated, on the latter test, the quality of avoiding a solution of the problem involved in the frustrating situation. The reverse characteristic on the Picture Frustration Study was found for those subjects who tended to adjust levels of aspiration readily in response to success and failure.

5. Subjects who tended to maintain high levels of aspiration (with little regard for actual attainment) in their performance on the Rotter Level of Aspiration Board demonstrated the following characteristics on the triad of reaction-to-frustration tests:

a. Picture Frustration Study - attempts to solve the problem inherent in the frustration were not made; instead the subjects exhibited the self-protective mechanism of disowning responsibility for the frustration and abandoning the ongoing action which had led up to the frustration.

b. Questionnaire of Blame Direction - subjects similarly avoided assuming responsibility for the frustration and further tended to deny the experience of any frustration.

c. Puzzle Situations - a denial of the experience of frustration was shown.

CONCLUSIONS

1. The hypothesis of a relationship between level of aspiration behavior and reactions to frustration has been partially substantiated.

2. The relationships were evidenced only with regard to performance on certain tests. Generalized performance on all tests of either of two behavioral categories was not seen.

3. The concept of a generalized behavior pattern for individuals in situations designed to observe reactions to changing levels of aspiration and to frustration has not been established.

4. Support for the theories of Gould and Sears regarding the protective and self-defensive nature of level of aspiration behavior has been given, although in a narrow range of description.

5. Future experimenters should concentrate on determining the characteristics of generalized LA behavior (if such exists), and on methods of

measuring reactions to frustration with the greatest validity. 146 pages. \$1.83. MicA 55-1497

**ROLE PLAYING IN SCHIZOPHRENIA:
A STUDY IN EMPATHY**

(Publication No. 12,058)

Isidore Helfand, Ph.D.
Columbia University, 1955

A normal group, a tubercular group, a chronic schizophrenic group, and a privileged schizophrenic group were tested on their ability to empathize with another individual, or to take his role. There were 64 subjects in all. All were given a series of screening tests to eliminate those with poor verbal facility. They were then given a Q-sort by which they could describe their own attitudes, feelings, and ideas about themselves. This test was composed of 80 items, 68 of which were from the MMPI. They were selected on the basis of their relevance to an autobiography written by a former hospital patient. This patient had taken the Q-sort following the writing of his life history.

After their sorting for themselves (Self Sort), the subjects were read the autobiography. They were then asked to take the Q-sort the way they thought the author of the autobiography would. This second sort (Simulated Sort) could then be compared to the sort made by the author of the autobiography. The degree of correspondence was the measure of empathy. A comparison was also made of the subject's initial similarity to the autobiographer. An estimate of the effect of this similarity factor could then be made.

The degree with which each subject in his group agreed with everyone else in his group was also determined and provided a measure of the relative homogeneity of perception within each group.

Results appear to warrant the following conclusions:

(1) Empathic ability is severely restricted in the chronic schizophrenic group.

(2) Schizophrenics who are sufficiently recovered to have privileges and be considered for discharge seem hypersensitive to others as reflected in their relatively high empathic ability.

(3) Normal individuals appear to be characterized by a relatively high degree of homogeneity of perception. Rather than high empathic ability, they reflect a more pronounced tendency to judge others in terms of widely shared stereotypes, group norms, or interpersonal "hypotheses." This conclusion, however, must be stated with emphasized tentativeness because of the insoluble problem in dependent observations posed by the data and the consequent lack of any rigorous statistical test.

(4) It is suggested that the relative "insensitivity" of the normal individual is a function of their excessive criticalness. They do not accept as readily as the privileged schizophrenics, for example, their critical projections. They are given to revaluations.

When criteria for a more accurate judgment is lacking, they fall back on social norms.

(5) It is suggested that since role taking skills or empathic behavior *per se*, are heightened in the remitted schizophrenic, an impairment here may not be causal to the disease.

(6) Hospitalization appears to have no deteriorating effect in and of itself on empathic behavior.

(7) Initial similarity to the individual one is to empathize with seems to have no direct effect on empathic behavior. The degree of acceptance of similarity appears to be more significant.

(8) The use of the autobiography rather than personal acquaintanceships appears to have validity in the study of empathy. It offers the advantage that larger groups than can ordinarily be tested can be conveniently studied. A comparison between the method of personal acquaintanceship and the autobiographical method should result in helpful methodological clarifications.

(9) A tangential hypothesis suggested by the data is that tuberculars, as a group, may be more seriously disturbed, in terms of their emotional relationships, than a comparable normal group.

101 pages. \$1.26. Mic 55-151

PROGNOSTIC FACTORS IN PSYCHONEUROSIS, MIXED TYPE

(Publication No. 11,981)

Shirley Mae Holt, Ph.D.
University of Minnesota, 1955

Major Adviser: Ephraim Rosen

The present project was designed to investigate characteristics of the diagnostic group, psychoneurosis, mixed type, as this label was applied to patients hospitalized on the psychiatric service at the University of Minnesota Hospitals during the years 1942-1948, inclusive. An effort was made to locate and interview each of the 199 patients who had received this diagnosis in order to evaluate his social adjustment at a minimum interval of five years since discharge from the hospital. This evaluation was converted into ratings made on a five-point scale ranging from a rating of no further difficulty to a rating of a great deal of difficulty since hospitalization. Of the 113 patients actually located and interviewed, about half continued to experience persistent difficulties or had recurrent episodes. About half of this "poor outcome" group had additional hospitalizations on psychiatric services. Slightly more than ten per cent later received a diagnosis of psychosis, but only one patient has remained overtly psychotic and institutionalized.

The hospital chart containing reports of the physical examination, mental status examination, psychological tests, history, notes on patients' adjustment during hospitalization, treatment methods used, etc., was located for 80 patients, 40 in the good outcome group and 40 in the poor outcome group. Each chart

was read by the writer or an assistant. Analysis of the chart was made with reference to a detailed schedule for notation of presence or absence, or a rating of the degree, of approximately 250 items related to personal history, characteristics of the present illness, and the medical history. The statistical procedure most extensively used for group comparison was chi squared. Factors found to differentiate patients with good posthospital adjustments from those with poor adjustments were as follows: high occupational level; more grades in school completed; more satisfactory paternal, maternal, and sibling relationships in childhood; more social participation; higher level of aspiration; initiative; less economic dependence; shorter duration of illness prior to hospitalization; progress toward adjustment during hospitalization; and sociability.

The first MMPI administered to each patient following hospitalization was obtained for 39 out of a possible 58 patients in the good outcome group and for 26 out of a possible 45 for patients in the poor outcome group. Mean profiles were computed for each group. In general, mean T-scores were higher for the poor group than for the good group, and the former is differentiated from the latter to a statistically significant degree on three of the eleven scales, Depression, Paranoia, and Psychasthenia. All profiles were coded according to the Hathaway method, and it was noted that a strong majority of profiles in both groups had primary elevations on the psychoneurotic scales. Profiles in the good outcome group were more likely to have primary elevations on the Hysteria scale than were profiles in the poor outcome group.

116 pages. \$1.45. MicA 55-1498

AN INVESTIGATION OF SOME RELATIONSHIPS BETWEEN PERSONALITY DISTURBANCE AND PERCEPTUAL REORGANIZATION

(Publication No. 11,854)

Eleanor A. Jacobs, Ph.D.
University of Buffalo, 1954

This study was designed to investigate the relationship between the severity of personality disturbance and the capacity for perceptual reorganization or "shift" on two concept formation tests. The tests selected for this purpose were the Feldman-Drasgow Visual-Verbal Test and the Wisconsin Card Sorting Test.

Two major hypotheses were tested in this investigation:

1. There is a relationship between severity of personality disturbance and difficulty in perceptual reorganization.
2. There is an inverse relationship between the severity of personality disturbance and the ability to learn a "set to shift."

Three groups of subjects were used, each containing 35 hospitalized male veterans. These groups were

matched for age, intelligence, and the length of time they had been hospitalized at the time of testing. The groups differed in the variable of personality disturbance. A group of non-psychiatric patients were selected as the normal control group. The other two groups contained neurotic and schizophrenic patients respectively.

Each patient was tested individually according to the following procedure:

1. A full-scale Wechsler-Bellevue Intelligence Test.
2. The Feldman-Drasgow Visual-Verbal Test.
3. An experimental variation of the Visual-Verbal Test.
4. Re-presentation of the previously missed concepts on the standard Visual-Verbal Test.
5. The Wisconsin Card Sorting Test.

The summarized results of the investigation include:

1. On the Visual-Verbal Test, normal and neurotic subjects performed in essentially the same way. They missed relatively few concepts in the original administration of the standard Visual-Verbal cards, and when given the opportunity to form these missed concepts on the experimental variation of the test, they were able to do so. Schizophrenic subjects missed a significantly greater number of concepts on the standard Visual-Verbal cards than did the normals and neurotics. When the schizophrenics were given the opportunity to form these missed concepts on the experimental variation cards, they were able to form 82.6% of the originally missed concepts. When the original stimulus situation was re-presented, they missed approximately the same number of concepts as they did originally. However, the missed concepts contained only half of the originally missed concepts, the other half contained concepts which were originally formed successfully.

2. On the Wisconsin Card Sorting Test, the subjects were required to form three concepts and to shift from one of these to another in a series of eight successive shifts. The normals demonstrated an initial degree of progressive difficulty in shifting, but soon learned a "set to shift" and thereafter demonstrated progressive ease in shifting. Neurotic subjects demonstrated a greater difficulty in making the first three shifts than did the normals. Thereafter, the neurotics learned a "set to shift" during the next three shifts but were unable to maintain it, thereby demonstrating subsequent greater difficulty in shifting. Schizophrenic subjects demonstrated an even greater degree of difficulty in shifting than did the normal and neurotic subjects. Their performance was sporadic and inefficient as they were unable to maintain a level of effective abstract behavior beyond a single shift.

The experimental findings of this investigation may be expressed in the generalized conclusions stated below:

1. There is a positive relationship between the severity of personality disturbance in a male veteran population and difficulty in perceptual reorganization.
2. There is an inverse relationship between the

severity of personality disturbance in a male veteran population and the ability to learn a "set to shift."

3. When a succession of perceptual reorganizations are required on a concept formation test, the behavior of normals and neurotics is significantly different, in contrast to the behavior of these groups on concept formation tests requiring one or less perceptual reorganizations.

Further research is needed in the field of concept formation to substantiate and expand these findings. The present experiment needs to be repeated with other groups of subjects such as a group of females, a non-hospitalized population, different age groups, and a population with a lower level of intelligence.

86 pages. \$1.08. MicA 55-1499

THE EFFECTS OF THREE VARIABLES ON CHILDREN'S CONCEPTS OF PHYSICAL CAUSALITY

(Publication No. 11,946)

Martin L. Nass, Ph.D.
New York University, 1954

Adviser: Professor Elsa E. Robinson

In an attempt to clarify some of the controversial reports in the literature on the development of children's concepts of physical causality, a study was made of the effects of differences in personality, in "experience," and in question wording on the nature of children's causal thinking. Piaget's theory states that the development of these concepts is determined largely by the age of the child, whereas other investigators have emphasized the role of intelligence and experience, among other factors. The present research was an attempt to explore the role of several variables which in previous studies either have been insufficiently considered or have not been considered at all.

One hundred twenty children of average intelligence, between the ages of 8-0 and 10-0, were examined, using the individual method. Sixty of the children were of "normal" emotional adjustment; sixty were withdrawn children whose personality difficulties had led to their referral to a child guidance clinic. Two sets of questions about the causes of a variety of phenomena were prepared, identical except that relative to Form B, the questions of Form A were worded so that they could more readily suggest the operation of non-naturalistic agents. In the second place, each of the questionnaires contained materials of two types, with regard to the experience variable. The questions of Experience Level I pertained to phenomena the causes of which the child was very likely to know through direct past experience; Experience Level II contained questions about phenomena the causes of which the child could not have directly experienced and about which it was improbable that he had learned through verbal means.

Responses to the questions were rated independently by three judges according to a modification of

Piaget's classification of the varieties of causal thinking. Agreement among the judges was unanimous for 95.7% of the responses. The number of responses classified as "non-naturalistic" were analyzed, using Wilcoxon's T test. It was found that:

1. The nature of the causal thinking of withdrawn children is at a significantly lower level than the causal thinking of normal children.
2. Questions about materials whose causal agents are not accessible to direct experience yielded significantly more non-naturalistic responses than did questions about materials whose causal agents are more accessible.
3. Questions worded so as to suggest the possible operation of "animistic," "supernatural," or "dynamic" forces yielded more such non-naturalistic types of responses than questions less suggestively worded.
4. Combinations of these factors, when compared with their "naturalistic-response-producing" counterparts yielded significantly more non-naturalistic responses.
5. Interaction tests indicated that the difference in number of non-naturalistic responses between familiar and remote materials was significantly greater for suggestively worded questions than for non-suggestively worded questions in normal children; also, that this difference was greater for withdrawn children than for normals on non-suggestively worded questions.
6. Supplementary tests indicated that suggestive wording produced a greater difference in number of non-naturalistic responses than did withdrawn personality or remote experience level. These findings were not statistically significant.

The author tried to reconcile the demonstrated importance of the personality variable with Piaget's theory of the growth factors influencing the development of causal concepts. Some evidence that Piaget recognized the possible relevance of the other two variables was found, principally in his later writings.

Despite Piaget's awareness of the fact that certain extrinsic factors may influence the child's conceptions of physical causality, the present results warrant the conclusion that he did not place sufficient emphasis on the roles of differences in personality, in experience, and in question wording. Causal thinking in children has been shown in this investigation to be significantly influenced by factors other than chronological age. 108 pages. \$1.35. MicA 55-1500

THE DEVELOPMENT AND STANDARDIZATION OF INDEPENDENT SCALES COMPRISED OF SIMPLE PERCEPTUAL SPEED TESTS

(Publication No. 11,570)

Robert Richard Phillips, Ph.D.
Washington University, 1955

Chairman: Philip H. DuBois

This study was undertaken to develop well defined and reliable tests of simple perceptual processes. Selection of test format was based upon the assumption that understanding of the complex proceeds from comprehension of the simple. Twelve naming, matching and reading tests were constructed in which all aspects of the perceptual act were controlled by equating the stimulus conditions among the tests. The tests differed in only two respects, namely, whether an attribute of simple word, color, or form was present in a neutral stimulus context or paired with an incompatible characteristic of one of the other two attributes.

The tests were standardized on a sample of 100 Veterans Administration hospital patients. The subjects were selected from routine referrals for psychological examinations. No restriction was placed on selection with the exception that the subjects were white males, of normal vision, and without diagnosis of organically induced cortical dysfunction. Use of this sample provides norms that apply in using the tests with subjects comparable to those commonly evaluated by clinical psychologists.

Descriptive data concerning age, intelligence, education, and occupational level are provided. Normative data, including means, standard deviations, and standard errors of measurement, are provided for each test. Each test has a high degree of internal consistency as attested by KR 20 reliabilities of .86 to .94. Equivalent form reliabilities range from .63 to .90. Error scores were too inconsistent to be of value in maximizing the time score reliabilities and were therefore discarded.

Differences between means of the tests reveal all but three tests to be significantly different in terms of difficulty. It can be said that the speed with which an attribute can be named is dependent upon the character of the attribute and whether it is paired with an incompatible attribute.

A "homogeneity analysis" was made of the inter-test co-variance matrix. Tests were combined into scales on the basis of their common variance. This technique revealed four independent and highly reliable measures of the following abilities:

1. ability to read simple words.
2. ability to recognize the outline of the stimulus.
3. ability to name colors.
4. non-verbal ability to match simple attributes.

The four scales are positively related to intelligence and education but are independent of age. The tests did not differentiate psychotic or neurotic patients from the medical patients in the sample. Within

the sample the more intelligent patients tend to carry either a psychotic or neurotic diagnosis rather than only a medical diagnosis.

The general conclusions are that highly reliable, clearly defined measures of simple perceptual processes have been standardized on a hospital population. Suggestions for further research with these clinical tools are made. 81 pages. \$1.01. MicA 55-1501

**IDENTIFICATION, DIFFERENTIATION,
AND EXTENSION OF SELF: A STUDY OF
PERCEPTIONS OF SELF, MOTHER, AND
DAUGHTER IN A SAMPLE OF
COLLEGE WOMEN**

(Publication No. 11,920)

Adrian Solomon, Ph.D.
Cornell University, 1955

This study was an attempt to meet the following research needs:

1. The need for dealing with variables of parent-child relationships which are of sufficient importance to exert a considerable influence upon the development of a child.
2. The need for dealing with normal characteristics rather than with pathological symptom formation.
3. The need to explore the implications of the concept of extension of self as it applies to the meaning which a child has for its mother.
4. The need for further study of the concepts of identification and its counterpart, differentiation.
5. The need for a phenomenological approach in exploring the concepts of extension of self, identification, and differentiation.

It was hypothesized that the subjects perceived their daughters as extensions of themselves. The specific predictions were that there would be positive and significant correlations between their perceptions of themselves and their perceptions of their daughters.

It was anticipated that the subjects in the sample had both identified with and differentiated from their own mothers. Specifically, predictions were made that there would be positive and significant correlations between the subjects' perceptions of themselves and their perceptions of their mothers. It was further predicted that these correlations would be significantly less than unity.

Rating scales, modifications of Murray's questionnaires for Autonomy, Dominance, Nurturance, Succorance, Abasement, and Deference were administered to eighty-nine women enrolled in a required course in the New York State College of Home Economics at Cornell University. The subjects rated three forms of each scale in terms of their perceptions of themselves, their daughters, and their mothers.

Product moment correlations were obtained between the perceptions of self, daughter, and mother on each of the six traits. In addition to testing the specific predictions, it was believed that an analysis of the inter-correlations between important traits might reveal patterns which are meaningful for a better understanding of personality development.

The major results were:

1. The correlations between the perception of self and perception of mother on a given scale ranged from .34 to .62 with an average r of .44. This represented the extent of the subjects' identification with their mothers.
2. For differentiation, the values ranged from .38 to .66 with an average r of .58. These values represented the extent to which identification was less than unity.
3. The subjects tended to want their daughters to be like themselves. The correlations between perception of self and perception of daughter ranged from .46 to .67 with an average r of .57.

There seems justification for the following conclusions based upon the findings of the study:

1. The subjects in the sample seem to want their daughters to be like themselves. This is in support of the hypothesis that mothers view their daughters as extensions of themselves.
2. The subjects have identified with and differentiated from their mothers. Studies of personality development should take into account differences as well as similarities between parent and child.
3. Analysis of the trait patterns of identification, differentiation, and extension of self based upon intercorrelation tables demonstrated a fruitful method for obtaining new insights into the dynamic aspects of parent-child relationships.

76 pages. \$1.00. MicA 55-1502

**RIGIDITY OF SELF-CONCEPT AS A
MECHANISM IN THE MAINTENANCE OF
PERSONALITY EQUILIBRIUM, AND AS
AN EXPRESSION OF THIS EQUILIBRIUM**

(Publication No. 11,956)

Alexander Tolor, Ph.D.
New York University, 1954

Adviser: Professor Leland W. Crafts

The purpose of the study was to determine whether the degree of self-concept rigidity is affected by experiences of success and failure and to determine whether the degree of rigidity of self-concept is related to the nature of an individual's other personality defenses.

The main hypothesis stated that frustration would be accompanied by an increase in both extreme

rigidity and extreme fluidity, with the predominant trend being in the direction of extreme self-concept rigidity.

An original test was devised to measure the degree of self-concept rigidity. This instrument consists of items referring to an individual's perception of himself under four different conditions: the present, the past, the future, and "different circumstances." The individual's responses to the last three conditions are compared in each case to the reply to the present condition and the degree of deviation yields a measure of rigidity-flexibility. The Self-Concept Test was validated on a group of 32 hospitalized patients, who were principally schizophrenics. The patients had been rated as being "clinically rigid" or "clinically fluid" by four clinical psychologists who based their judgments on symptomatology and behavioral descriptions as found in the medical charts. The Self-Concept Test was also validated on a group of 66 undergraduate students by using their performance on a series of water bucket problems as a criterion.

In the actual experiment, for which 97 college students served as subjects, the procedure consisted of the following:

1. Administration of the Self-Concept Test
2. Administration of a sentence completion test which was designed for the purpose of ascertaining the number and kind of defense mechanisms used.
3. Administration of the Henmon-Nelson Test of Mental Ability.

After an interval of one week, subjects were assigned randomly to one of three groups: a frustration group, a success group, or a control group. Subjects in each group were equated with each other for age and intelligence, and were also approximately equal in self-concept rigidity. Subjects in the frustration group were given false results which were intended to create a feeling of failure on the intelligence test. Subjects in the success group were given information to the effect that they had done exceptionally well on the intelligence test. The control group was not provided with any information concerning intelligence test performance. The Self-Concept Test and the Defense Mechanism Test were then re-administered, and some of the subjects were persuaded to respond to a questionnaire which was designed to evaluate the effectiveness of the induced experiences of frustration and success.

In the validation studies it was found that rigidity as measured by the Self-Concept Test is related to clinical rigidity of patients and to rigidity as determined by the Einstellung method. An analysis of the experimental data yielded the following results: All groups showed a significant increase in rigidity on re-examination but there were no significant differences in mean change in rigidity scores among the three groups. The variability of the success group increased significantly whereas that of the frustration group did not. The data also indicated that "clinically fluid" patients were significantly more fluid than the

students following an experience of frustration or following an experience of success. However, the "clinically rigid" patients did not differ significantly from any of the experimental groups. The hypothesized relationship between the degree of self-concept rigidity and the number and kind of other personality defenses was not generally confirmed.

The findings were discussed in terms of the instruments used, the experimental conditions, and theoretical considerations, with particular reference to self-concept theory.

182 pages. \$2.28. MicA 55-1503

EXPECTANCY FOR EVENTUAL SUCCESS AS A FACTOR IN PREDICTING PROBLEM SOLVING BEHAVIOR

(Publication No. 12,041)

Bonnie Wallis Tyler, Ph.D.
The Ohio State University, 1954

Adviser: Julian B. Rotter

This study is designed to determine if a "situational" expectancy may be established for eventual success or failure in a problem solving situation which in turn affects the individual's performance. The concept of expectancy utilized here is derived from Rotter's social learning theory in which he defines expectancy as the probability held by an individual that a specific behavior will lead to a specific reinforcement. Relevant expectancies are established through the use of differential verbal reinforcements for the three experimental groups. The verbal reinforcements include encouragement, discouragement, and a combination of the two. No comments are made to the control group.

The prediction is that significantly more subjects who have developed a high expectancy for solving the problem will solve the problem logically than will subjects whose expectancy for solving the problem is lower than that of the encouraged group (i.e., subjects in the discouraged, inconsistent, and control groups). It is also predicted that significantly fewer subjects in the verbally discouraged group will solve the problem than will subjects in the inconsistent and control groups.

It is further hypothesized that there will be an inverse relationship between the time required for making a response and the overall expectancy for positive reinforcement to occur.

The problem to be solved requires the conceptualization of a mathematical pattern according to which a series of lights is flashed. The three experimental groups are verbally reinforced during the first thirty trials of the experiment, regardless of the correctness or incorrectness of their responses. The problem is purposely too difficult to be solved during the thirty verbally reinforced trials; following these, the subject is given a hint about the solution and is allowed fifty more trials, without verbal reinforcement, in which to solve the problem.

Analysis of the results reveals that the differences in the number of subjects in each group solving the problem logically all occur in the predicted direction. The difference between the encouraged group and the discouraged group is significant beyond the 5 percent point, and three other differences approach significance. When the data are analyzed on the basis of the criterion with allowance for either a logical or memorized solution to the problem, the differences between the groups in the number solving the problem are not significant.

As for differences in decision time, in four of the six group comparisons the average decision time is significantly larger for the subjects with a low expectancy for positive reinforcement than for the subjects with a high expectancy for positive reinforcement. This inverse relationship occurs, however, only during the thirty trials in which verbal reinforcement is given; during the subsequent non-reinforced trials there is little difference between the groups in average decision time.

General findings are as follows: (1) Significantly more subjects in the groups with the lowest expectancy for success use memorization to solve the problem. (2) Comments made during the experiment and in an interview after completion of the test show that the subjects in the discouraged group express considerable hostility toward the experimenter and toward the problem to be solved, as well as toward themselves for failing to solve the problem as quickly as they feel they should. This reaction is also characteristic of the inconsistent group, although it does not occur as frequently. There is little expression of hostility in either the encouraged or the control group. (3) There is a tendency toward more frequent recall of positive statements, even in instances where the reinforcement is negative, or both positive and negative. (4) There are no significant differences between the groups in the number expecting to solve the problem (verbal statement of expectancy), and there is little relationship between the stated expectancy for solving the problem and the actual solving of it.

95 pages. \$1.19. MicA 55-1504

AN INVESTIGATION OF THE CONCEPT OF FUTURE TIME PERSPECTIVE IN SCHIZOPHRENIA

(Publication No. 12,156)

Melvin Wallace, Ph.D.
Michigan State University, 1954

This study was concerned with an investigation of two aspects of the concept of "future time perspective," "extension" and "coherence." The specific hypotheses regarding these variables that were examined in the present research were:

(1) When schizophrenics are compared to normals, significant differences in "extension" will be found between these groups.

(2) When schizophrenics are compared to normals

significant differences in "coherence" will be found between these groups.

One sample of 34 patients, diagnosed as schizophrenic, and a group of 34 patients at a general medical and surgical hospital were given three tasks which involved: (1) the spontaneous, and the later, a forced ordering of a series of ten future events (Task I); (2) four stories in response to verbal instructions which included the beginning of each story (Task II); and (3) estimates of the age of occurrence of 15 future events, supplied by the examiner, which were later placed in order of expected occurrence (Task III).

The results obtained on the basis of a comparison between the experimental and control groups by use of a non-parametric procedure, the H-test, indicate that (a) on all measures except those found on Stories 1 and 2 of Task II, the scores on both the "extension" and "coherence" variables presented by the schizophrenic group were significantly different than the corresponding scores of the control group, and (b) on all tasks, including those which reveal a lack of significant difference, the median score of the control group was larger than that of the experimental sample.

Additional non-hypothesized findings included: (a) the performance of a sample of "long-term" schizophrenic patients did not deviate to any significant extent from that of a "short-term" schizophrenic group on either variable, except on Task I when one measure of "coherence" was derived, (b) normals and schizophrenics do not differ significantly with regard to measures of correlation which refer to the degree of relationship between the spontaneous sequence of a series of future events and the actual chronological order of these events, and (c) correlations between the spontaneous sequence of the presented series of future events and a forced chronological ordering revealed statistically significant intergroup differences.

The obtained results, for the most part, confirmed predictions which were derived from the following general hypothesis: "Future time perspective" is significantly affected by psychopathological disturbance. The lack of significant findings in connection with Stories 1 and 2 of Task II was interpreted on the basis of the fact these two experimental procedures, in contrast to Stories 3 and 4, were highly structured, and presumably relatively free of threat, thus allowing the particular schizophrenic subjects under investigation to function optimally.

In general then it may be stated that "future time perspective," in its "extension" and "coherence" aspects, is influenced by the schizophrenic process to such an extent that both the length of the future time span, and the degree of organization of its contents, are significantly reduced for a sample of schizophrenic patients as compared to a group of normal controls. Further research, involving longitudinal studies and the investigation of other nosological groups, is needed before a final evaluation may be made of the role of "future time perspective" in both "normal" and abnormal personality functioning.

94 pages. \$1.18. MicA 55-1505

PSYCHOLOGY, EXPERIMENTAL

MEASURED VISUAL ACUITY AS A
FUNCTION OF PHENOMENAL SIZE

(Publication No. 12,004)

Earl Arthur Alluisi, Ph.D.
The Ohio State University, 1954

Adviser: John R. Kinzer

In a daylight situation favorable to the operation of size constancy, 36 observers (S-group) read a retinally projected visual acuity chart at three convergences and, thus, at three apparent distances and three conditions of phenomenal size of the chart. An additional 36 observers (R-group) read the same retinally projected chart under similar conditions, but in a stimulus-reduced night situation not favorable to the operation of size constancy; for this group, phenomenal size of the test chart remained constant. The results and conclusions were:

1. Acuties obtained at the three convergences differed significantly among themselves for the S-group but not for the R-group. This seems to establish measured visual acuity as a function of phenomenal size of the test chart.
2. This effect was so small (less than one Snellen rating) that it appears to be of little practical or clinical value. It does offer support, however, to those theories allowing for central factors in measured visual acuity, though one such theory has been shown to be inconsistent with the data.
3. Evidence for convergent accommodation was negative, as was evidence for proximal accommodation.
4. The data suggest that the Aubert-Foerster phenomenon is specific to the periphery and should not be generalized to the central retinal region.
5. It is suggested that some of the differences among the seemingly contradictory results reported with regard to the relation of acuity to distance of measurement can be properly explained in terms of differences in phenomenal size changes of the test object within the separate studies.

32 pages. \$1.00. MicA 55-1506

THE EFFECT OF PERCENTAGE OF
REINFORCEMENT AND DISTRIBUTION
OF TRIALS ON RESISTANCE TO
EXTINCTION OF A CONDITIONED
FEAR RESPONSE

(Publication No. 12,096)

Harvard L. Armus, Ph.D.
State University of Iowa, 1955

Chairman: Professor Judson S. Brown

On day 1, each of a group of hooded rats was given 7 adaptation trials to a loud, percussive sound while in the confinement box of a spring-loaded stabilimeter

device. The typical unconditioned response to this startle stimulus (loud sound) resulted in a momentary downward depression of the confinement box, these movements being transmitted to an ink-writing muscle lever. The following day, each animal received a number of electric shocks while in this confinement box, the assumption being that fear would become conditioned to the box cues. The third day involved a series of 12 extinction trials in which only the startle stimulus was presented.

The purpose of this study was to test an application to the case of a conditioned fear response of the Hull-Sheffield hypothesis concerning resistance to extinction. To this end, the basic design was a 2 x 2 x 2 factorial, the factors being percentage of reinforcement (50 and 100) and intertrial interval during both acquisition and extinction (1 min. and 30 min.) An analysis of variance yielded no significant F values, either for main effects or interactions, a result contrary to predictions based on both the Hull-Sheffield view and the contrasting "expectancy" principle. Three possible explanations for these rather surprising results were suggested and briefly discussed. The most plausible explanation was that the extremely large error variance (probably the result, at least in part, of the marked heterogeneity of the animals) served to mask any differential effects of the experimental variables.

63 pages. \$1.00. MicA 55-1507

THE QUANTIFICATION OF DRIVE III.
PRIVATION OF FOOD AND WATER

(Publication No. 12,148)

Richard A. Behan, Ph.D.
Michigan State University, 1955

The present thesis was concerned with a test of the Hullian theory of drive, using privation with respect to food and with respect to water. The position was formalized, and consequent theorems were tested.

A combined activity box and panel-pushing device was used in the present study. The panel-pushing device was so arranged to provide a measure of force of response, and of the number of trials to extinction.

Forty-eight male albino rats were used as subjects in the study, and were divided into two major groups:

1. Twenty-four animals deprived of water;
 - a. Twelve animals given a large reward (0.20 cc)
 - b. Twelve animals given a small reward (0.12 cc)
2. Twenty-four animals deprived of food;
 - a. Twelve animals given a large reward (0.32 gm)
 - b. Twelve animals given a small reward (0.08 gm)

All animals were given habituation training in the apparatus during the first five days of the experiment,

while on an ad libitum feeding schedule. Activity level was recorded.

On days 6 through 13 all animals were trained on the panel-pushing task, under 22-1/2 hours of appropriate privation and reward. Each animal was given ten trials per day. Activity level was recorded on all 8 days, and force of response was recorded on the last 3 days.

At the completion of the training series the animals went immediately to the testing series, where they were tested after different numbers of hours of privation, i.e., on 1, 2, 6, 12, 22-1/2 and 48 hours of appropriate privation. The order of presentation of privation levels was randomized for each animal. Each animal was given 4 trials per day. Activity level and force of response were recorded each day.

At the conclusion of the testing series each animal was extinguished on one of the above mentioned hours of privation.

The results are as follows:

1. Activity is not a reflection of privation, *per se*, but is rather dependent upon the amount and kind of reward in interaction with privation, and on a learned anticipation of reward.

2. A general concept of drive is not tenable, because the correlation between the food and water groups, when activity is constant, was not significant.

3. A drive concept is not tenable, because the water groups did not show the increase in behavior measures which the large food group showed.

4. There is a significant interaction between the kind of reward substance and the privation level.

5. There is a significant interaction between the amount of reward substance and the privation level.

The implications of the study for activity as a measure of drive, and for drive as an explanatory construct, were discussed.

The category of need was discussed, and an alternative interpretation of need, as interaction, was suggested. 110 pages. \$1.38. MicA 55-1508

THE MOTIVATION OF SUGAR PREFERENCES IN THE ALBINO RAT

(Publication No. 11,906)

Harry Lewis Jacobs, Ph.D.
Cornell University, 1955

The general problem with which this dissertation is concerned is the motivation of sugar preferences under normal feeding conditions, and under experimentally-induced need for sugar. The literature in general hunger, specific hunger, and sugar preferences is reviewed, with special attention to the concepts of learning, palatability, and homeostasis as factors influencing food choice.

Three experiments are reported. The first two experiments deal with the effect of insulin on the intake of food (stock diet) and sugar solutions. The third experiment is an exploratory investigation of the effect of alloxan diabetes on the intake of food and

sugar solutions. Direct measures of blood sugar level were not available, but it is argued that the independent variables were changes in blood sugar level. The findings and interpretations are:

1. Under normal ad libitum feeding conditions, rats, when presented with a choice between food and sugar solutions, will decrease their food intake (in comparison to the intake when sugar is not available for choice), increase their sugar intake, and select the less sweet solution. The same choice is also made when the molarity of the solutions is made equal, although they differ in sweetness. This choice for the less sweet solution is assumed to be a function of the palatability of the stimulus-object, and independent of the need state of the organism.

2. Under insulin-produced hypoglycemia, although food and total sugar intake increase, the greatest effect is on sugar intake. It is concluded that hypoglycemia produces a specific hunger for sugar.

3. Under insulin-produced hypoglycemia, the sweeter solution is preferred. This occurs whether the sweeter solution is efficient (glucose) or inefficient (fructose) in raising the blood sugar level. It is concluded that the effect of hypoglycemia is to change the standard of preference to the sweeter solution, regardless of its need reducing properties. Homeostatic factors are assumed to be mediating these changes. The data are consistent with the hypothesis that a depression of taste threshold occurred.

4. The selection of the sweeter solution under conditions of hypoglycemia was temporary. This is assumed to result from the fact that the animals ingested enough sugar to raise the blood sugar above the critical level; after this point is reached, the choice is again mediated by palatability.

5. In the second experiment, three animals died in hypoglycemia. This was associated with an uncontrolled rise in environmental temperature. The deaths are attributed to an attempt to maintain body temperature by decreasing food intake even though hypoglycemia was present. Thus, the need to maintain body temperature seems to be prior to the need to maintain a constant blood sugar level.

6. Normal hyperglycemia, induced by the sudden removal of exogenous insulin, decreases food and sugar intake. Animals in diabetic hyperglycemia increase their food and glucose intake. These results are interpreted to mean that blood sugar level is a sufficient, but not a necessary factor in the regulation of hunger.

7. The alloxan diabetic animal continued to take large amounts of sugar even though an olive oil choice was available. These results are contrary to what was previously found with pancreatectomized diabetic rats. The latter decreased their sugar intake and increased their fat intake. The discrepancy in results is referred to two possibilities. (1) The alloxan diabetic rats were presented with a palatable sugar solution; the pancreatectomized rats had granulated sugar available. (2) Pancreatectomy destroys the source of the pancreatic digestive enzymes as well as the insulin-producing cells; the enzyme loss may induce a need for fat and thus increase olive oil intake.

The only two concepts used to explain the data

in these experiments are homeostasis and palatability; it was not necessary to bring in a learning factor. 176 pages. \$2.20. MicA 55-1509

THE CONTIGUITY PRINCIPLE AND THE SKAGGS-ROBINSON HYPOTHESIS

(Publication No. 7619)

Junius M. Rowe, Ph.D.
The University of Tennessee, 1955

Major Professor: E. O. Milton

This study has been concerned primarily with a demonstration of the Skaggs-Robinson hypothesis within the framework of the Guthrie principle of reinforcement. In accomplishing this demonstration several experiments had to be performed as basic studies. Out of these investigations, several important factors evolved in addition to the test of the Skaggs-Robinson hypothesis.

In order to use the Guthrie principle of reinforcement most effectively a response already in the repertoire of the albino rat (the common rearing response) was chosen because no artificially induced need would be required to elicit the response. Hand removal from an open field situation was chosen because this was an effective way to completely change the hierarchy of cues present at the time the response occurred, and thus the last response in the situation should be learned because no other response could be associated with the cues present at the time this last response occurred. It was demonstrated that the rearing response could be conditioned and maintained by hand removal as the reinforcing agent.

Following the demonstration that rearing could be conditioned and maintained by hand reinforcement, it was necessary to set up three experimental situations to be used in the final test of the Skaggs-Robinson hypothesis. The three situations (A, B, and C) were constructed such that two of them (A and C) were at the extremes of a similarity-dissimilarity continuum in terms of the cue change from one extreme situation to the other extreme situation. Another situation (B) was constructed such that it was approximately midway between the two extremes on the cue continuum. The three situations were then compared for the number of rearing responses each would elicit from animals which were trained and tested in the same situation. It was demonstrated that there were no significant differences in the number of responses each situation would elicit when the animals were trained and tested in the same situation, i.e., trained in A and tested in A, trained in B and tested in B, and trained in C and tested in C.

If these situations were adequate for a demonstration of the basic hypothesis, there should be a decremental function when animals were trained in one situation and one-third of them was tested in the same situation and one-third of them tested in each of the other situations because of generalization decrement which has been shown in a large number of cue change situations. It was demonstrated that

when training trials were kept to a small number and were distributed at twenty minute intervals, there was a significant decreasing curve of the number of rearing responses from A to B to C.

Once these points were established, it was possible to test the Skaggs-Robinson hypothesis by giving animals original training trials in one situation (A), interpolated training trials in A, B, and C (one-third in each), and a test in situation A. This procedure substantiated the Skaggs-Robinson hypothesis in showing a decrement in response strength when some cue change was made and a recovery above this level with maximal stimulus dissimilarity.

The Skaggs-Robinson phenomenon emerged when a large number of massed training trials were employed, but the effect appeared to be artifactual because a decreasing function failed to occur under generalization decrement conditions. This artifact arose by way of the transfer of delayed latency from the training trials to the test situation when cues were held constant with massed training. This effect was partially eliminated in the second test of the Skaggs-Robinson hypothesis by reducing the number of training trials and increasing the inter-trial interval and resulted in an increased probability of a real effect. When the animals of the Generalization Decrement III Experiment were matched with the animals of the Skaggs-Robinson II Experiment in terms of the median latency of the first rear in the first five training trials, the statistical significance of the effect was increased and further evidence was provided that the Skaggs-Robinson hypothesis is tenable.

The major conclusion of these nine experiments was that the Skaggs-Robinson position is a tenable one. The phenomenon was demonstrated by varying the stimuli and holding the response operationally constant. 119 pages. \$1.49. MicA 55-1510

EFFECTS OF ELECTROSHOCK CONVULSIONS ON LEARNING IN RATS AS A FUNCTION OF AGE

(Publication No. 11,955)

James Vincent Tattan, Ph.D.
New York University, 1954

Adviser: Professor Leland W. Crafts

The chief hypothesis tested was that young rats whose brains are immature in terms of volume will show greater learning impairment following a series of electroshock convulsions than will older rats with more mature brains.

A total of 120 male albino rats were distributed equally among eight groups in accordance with a "2 x 2 x 2" analysis of variance statistical design. The three variables were the age of the rat at the beginning of treatment (24 days vs. 125 days), treatment (electroshock convulsions vs. "pseudo-shock") delivered at the rate of two per day for five consecutive days, and period of delay between termination of treatment and beginning of learning trials (2 days vs. 30 days) in the Lashley III swimming maze.

Convulsions were induced in experimental groups by 40 volts to the younger animals and 60 volts to the older animals through ear-clip electrodes for 0.5 sec. Escape from water was the motivation for learning. Total errors and time per trial per animal were recorded and analyzed as well as the number of trials required to reach an arbitrary criterion of errorless trials. Animals were also weighed at four stages of the experiment.

1. All convulsed groups showed learning impairment in terms of all three scores of performance as compared with control groups, differences between mean scores being significant at the .01 level of probability or better.

2. Vincent-type learning curves, plotted in terms of error elimination, showed that the impairment of convulsed animals was apparent throughout the course of learning.

3. Experimental animals did not recover to a significant degree from the impairing effects of the convulsions over the two test periods.

4. Younger animals showed no more or less impairment than older animals at either of the test periods.

5. Older animals took more time to reach the criterion than younger animals, group differences being significant beyond the .001 level of probability.

6. Animals tested at the longer delay period took more time to reach the criterion than animals tested at the shorter delay period, group differences being significant at the .05 level or better.

7. Significant differences between the mean weights of experimental and control animals appeared only at the measurement period immediately after the termination of treatment when experimental groups weighed less than control groups, differences being significant at the .03 level of probability or better.

The learning impairment of convulsed animals was tentatively attributed to autonomic system alterations. The insignificant rate of recovery over the two test periods indicated that electroshock convulsions had relatively enduring effects upon learning and its physiological substrate. If learning impairment was more or less directly related to brain alterations, the relatively immature brain of the young rat was no more or less severely affected than the relatively mature brain of the older rat. Differences in time scores which arose regardless of treatment applied as functions of the age and delay conditions were both attributed to decreases in

swimming speed as functions of factors associated with the age of the rat.

108 pages. \$1.35. MicA 55-1511

STIMULUS COMPLEXITY AND THE RECOGNITION OF VISUAL PATTERNS

(Publication No. 12,194)

Meyer Weinstein, Ph.D.
The Ohio State University, 1955

In a series of three experiments *S* were required to select a specific figure from among groups of similar figures. The size of the groups from which the selection was made was varied. The number of columns in each figure as well as the number of column heights was also varied. The results and conclusions are:

1. The time required for *S* to identify a specific figure is a function of
 - a. the size of the total population of figures from which the specific figure is selected, and
 - b. the size of the comparison group of figures (all generated by the same rules) from which the selection must be made.

It was suggested that many perceptual processes involve the rejection of redundant or unwanted information and the use of some small part of the potential information available in the stimulus. The sorting task used in this study is probably of this nature. Unlike a situation in which *S* is required to reproduce the stimulus pattern, i.e., process all the information in the stimulus, the sorting task requires that *S* process only part of the total information available. In a situation such as this *S* can choose many different ways of identifying a figure. The present results suggest:

- a. that *S* whenever possible, makes his discrimination on the basis of some unique aspect of the stimulus pattern, and
- b. that it may be easier for *S* to disregard the complexity of the details (bits per column) than the number of details (columns).

61 pages. \$1.00. MicA 55-1512

SOCIAL PSYCHOLOGY

AN EXPERIMENTAL STUDY OF THE LEADER VARIABLE AND EGO-INVOLVEMENT AS FACTORS INFLUENCING JUDGMENT

(Publication No. 11,677)

David Livingston Cole, Ph.D.
Claremont College, 1954

This study attempted an experimental investigation of certain aspects of the leader variable as well as the effect of an increase in follower ego-involvement as factors influencing the likelihood of the followers changing their judgments regarding a series of ambiguous stimuli.

The following hypotheses were investigated:

1. The leader-follower relationship must be looked upon as a field situation and such a field will be structured and remain structured only when the views of the leader are acceptable to the followers.
2. The leader-follower field will be extended to the degree that the leader is seen to have authority to assume the leader role. As the relation of the leader's apparent right to authority is moved progressively away from the problem area confronting the group, there will be an increasing tendency for the leader-follower field to disintegrate.
3. The leader-follower field will be extended if the leader is allowed to implement his prestige based judgements with rational appearing arguments.
4. In situations which are relatively non-threatening to the followers, rational appearing arguments will be more influential than mere prestige based authoritarian judgements.
5. The influence of the factors cited above will hold when the problem is one which is relatively non-threatening to the persons involved. As ego-involvement rises markedly because of increased threat, idiosyncratic factors, which will be a function of the individual personalities involved, will have a greater influence upon the results.

To test these hypotheses, four experimental approaches were used. These were respectively, an experiment with a modified administration of the group Szondi, a "design judgment" experiment in the evaluation of finger paintings and a series of experiments with the auto-kinetic effect, modeled after the work of Sherif. Not all of these experiments tested each of the above hypotheses, but between the experiments, all of the hypotheses were investigated. The "t" test of significance and/or Chi Square were used throughout in arriving at statistically based conclusions.

Subjects: The subjects in these experiments were undergraduate students, chiefly sophomores, enrolled in Introductory Psychology courses at Occidental College. Five hundred and twenty subjects served in one or more phases of the experiments.

The Szondi experiment: In this experiment, the subjects were asked to indicate their preferences to the faces in the Szondi test. Comparisons were made with their subsequent responses after labels were attached to the faces, presumably indicating the patient's diagnosis. There was evidence that such labels influenced the subjects' responses, but that the subjects apparently did not respond merely to the diagnosis as they believed the psychiatrist perceived it, but in terms of their own value systems as well. Thus their susceptibility to suggestion was modified by personal values, as Hypothesis I would predict.

The "design judgment" experiment: In this experiment, subjects were asked to indicate the more meritorious in each of 24 pairs of abstract designs, both before and after being shown the prior ratings of "other judges." By systematically varying the presumed source of such "other ratings" it was possible to show that the closer the "other source" stood to the field of art, the greater the influence. This was considered as supporting Hypothesis II.

The finger painting experiment: This experiment compared the relative influence of four sources of suggestion (1) rational authority source using rational appearing arguments; (2) rational authority source lacking rational appearing arguments; (3) "irrational" authority source using rational appearing arguments. The results suggested that the rational appearing arguments were important in determining follower suggestibility and that such arguments outweighed mere prestige suggestion. Hypotheses 3 and 4 were considered supported.

Experiments with the autokinetic effect: Following Sherif, subjects were exposed to the estimates of the light's movement by a plant, who attempted to influence their judgment. By varying the deviation of the plant and the set of the subjects concerning the nature of the task, it was possible to test both Hypotheses 2 and 5. Hypothesis 2 found support in that when the plant was presented as an "expert" he proved more influential. While the reactions under conditions which increased ego-involvement by defining the task as related to either I.Q. or personality showed marked deviations from the other conditions, Hypothesis 5 was felt to receive only tentative support.

Conclusions: While the conclusions must be limited to the selected sample used for the study, within these limits it was concluded that:

1. The subjects showed marked limitations to their suggestibility.
2. A marked increase in ego-involvement on the part of the followers may modify their response to a leader figure.
3. Susceptibility to leader suggestion may be characterized in two ways: (1) as adopting the leader's frame of reference, or (2) by retaining one's prior frame of reference, but accepting minor modifications in this as a result of interaction with the

leader. The latter form was more in evidence in the present study.

4. Leadership can be best conceived in field terms.

5. The leader's influence is extended when he is perceived as having authority to speak to the issue at hand.

6. Despite point 5, where ego-involvement is relatively low, rational appearing argument is more effective than undefended prestige-suggestion.

292 pages. \$3.65. MicA 55-1513

FRESHMAN CAMP: A THEORETICAL STUDY OF INTERPERSONAL INFLUENCE

(Publication No. 11,898)

Bruce Philip Dohrenwend, Ph.D.
Cornell University, 1955

The problem was twofold: first, to formulate a theoretical framework or model for the study of interpersonal influence under conditions of face-to-face interaction and second, to explore the theoretical model in a suitable research setting. In the theoretical model, interpersonal influence in face-to-face interaction is considered as capable of taking place under three different sets of antecedent conditions:

1. where all statuses in the internal system are chosen;
2. where all statuses in the internal system are imposed and formal authority, stemming from the relevant external system, is experienced by the interacting individuals as applying equally to each of them.
3. where one or more statuses is imposed and formal authority is experienced as applying unequally by the interacting individuals.

For each set of antecedent conditions, propositions and hypotheses are set forth to predict:

1. the structure and characteristics of the internal system as a whole as these develop over time and
2. the specific behavior of the self in relation to other(s) in the course of face-to-face interaction.

The research setting chosen for the exploration of some of the hypotheses of the model was a men's Freshman Camp at a large eastern university. The camp was planned and run by upperclassmen for incoming freshmen. The 230 campers and 34 upperclassmen counselors constitute the subjects of the research, the occupants of the statuses in the internal system of Freshman Camp. The camp was run from September 15, 1953 to September 18, 1953.

The research design employed a self-administered camper questionnaire at the beginning and at the end of camp, a counselor observation schedule that was filled out after each meal, and a camper sociometric

questionnaire which was filled out at the end of camp. Counselors and the director staff were asked to fill out final reports after camp. These reports were often supplemented with and occasionally substituted for by intensive interviews. In addition, certain materials, although not designed for purposes of the study, were available for analysis. These included the written applications (successful and unsuccessful) for counselor jobs, camp brochures, and questionnaire data previously collected on random samples of the undergraduate student body.

It was possible to establish that Freshman Camp conformed to the first condition described above: that of an internal system in which virtually all statuses are chosen. The relevant propositions and hypotheses of the theoretical model were, therefore, those designed to predict the interactive relationships under this condition of chosen statuses in the internal system.

On the level of the structure and characteristics of the internal system as a whole, the results indicated, as hypothesized, that:

1. when the effective values of the interacting individuals tended to be similar in strength and direction, the use of force in the internal system was minimal;
2. when the effective values of the interacting individuals tended to be similar in strength and direction, rank in the system tended towards equality;
3. when the effective values of the interacting individuals tended to be relatively dissimilar, rank in the internal system tended towards relatively inequality.

On the level of the behavior of the individual in the internal system, the results indicated, as hypothesized, that:

1. when the effective values of the interacting individuals were similar in strength and direction, the role-behavior of the self actively conformed, publicly and privately, to the role-prescriptions of others;
2. when effective values were relatively dissimilar, there was relatively less public conformity of the role-behavior of the self to the role-prescriptions of others.

Contrary to hypothesis, however:

3. although more change in effective values tended to take place where there was relatively greater dissimilarity of effective values, there tended to be more change among campers with greater capacity, skill or strength than among those with lesser capacity, skill or strength.

The main index of relative capacity, skill or strength was past leadership experience as against no past leadership experience as ascertained from university records. This last mentioned result indicates that greater weight should have been assigned

in the theoretical model to the consistency vs. inconsistency of an individual's values. Unfortunately there is no index of this concept in the present study.

243 pages. \$3.04. Mic 55-152

SUBMISSION TO SOCIAL INFLUENCE IN FACE-TO-FACE GROUPS

(Publication No. 11,975)

Richard Marc Emerson, Ph.D.
University of Minnesota, 1955

This study represents an attempt to formulate and test certain hypotheses concerning the determinants of submission to influence or conformity in small face-to-face groups. Three problems were involved: (1) delineating the area; (2) constructing a theory and hypotheses; and (3) devising and conducting a research program in testing these hypotheses.

A review of recent literature bearing upon submission by individuals to influence in small social groups isolates some variables and relationships as relevant. This review shows the following general hypotheses to be maintained by current students:

(a) In situations where an objective standard for behavior exists, submission to group influence varies directly with the ambiguity of that standard. (b) Submission to group influence varies directly with motivation toward group membership. (c) Submission is related in some manner to position held in the group structure. The specific nature of this relationship is not made clear in existing studies.

In the study of "c" above, a theory of group structure and member motivation is designed to summarize existing evidence and to provide a basis for the derivation of additional hypotheses. Four hypotheses are so derived for test:

- Hypothesis 1. Submission to influence varies directly with motivation toward membership in the group.
- Hypothesis 2. Submission on a given form of behavior varies directly with the extent to which other group members expect that behavior of the subject.
- Hypothesis 3. Submission varies directly with insecurity (uncertainty of position held in the group, or continued occupancy in the position).
- Hypothesis 4. Submission varies directly with perceived own deviation from a standard set by the group.

The research procedure followed in testing these hypotheses includes laboratory manipulations of insecurity and perceived deviation. Field measurements of motivation, perceived acceptance in the group, and level of expected performance are independently examined. A major property of the present study is the use of "real" social groups (Boy Scout patrols) in a laboratory study. Both experimental and field

procedures were used in the study, one furnishing a check upon the other.

The findings confirm the four hypotheses listed above. In addition, it was found that group members are more likely to submit to influence if they are highly dependent upon that group, not deriving equivalent satisfactions from other groups.

133 pages. \$1.66. MicA 55-1514

ASSESSMENT OF LEADER ADEQUACY FROM STRUCTURED QUESTIONNAIRE RESPONSES OF VOLUNTARY GROUP MEMBERS

(Publication No. 11,990)

Donald Warren Olmsted, Ph.D.
University of Minnesota, 1955

Adviser: Elio D. Monachesi

A survey of the relevant literature concluded that:

1. Most sociologists and psychologists apparently agree that a "situational" approach has advantages over the earlier "trait" approach to phenomena associated with group leadership.

2. Some of the difficulties of implementing the situational approach are widely unappreciated.

3. Development of procedures of analysis of questionnaire responses has lagged, compared to related instruments.

4. Rigorous analysis of questionnaire responses depends on finding ways of objectively "seeing through" manifest responses to get at underlying or latent patterns.

5. Two stable factors which can implement the explanation of variation of such responses are: characteristics of items, and characteristics of respondents.

The responses of 451 members of 39 college-student groups to 22 fixed-response items pertaining to the behavior and adequacy of leadership of the formal group leader were subject to analysis of variance, using a "repeated measurements" model. The three resulting F-ratios were all highly significant statistically. The interpretations were: responses of individual members were group-related and group means were meaningful values; the items had stable, culture-based, response-drawing characteristics; the content of certain items was perceived by the members of certain groups as bearing some "special" relationship to the group-leader interaction.

Based on the F-ratios mentioned, an "adjustment" procedure was devised for the group-item means of the "Leader Favorableness" (LF) measure, freeing them, it is maintained, from the "halo" effect of responses to the group leader, and from the differential response-drawing attributes of the items. Two analyses were conducted as partial tests of the validity of the adjustment procedure. A "bureaucratic-charismatic" item-content dichotomy and a dichotomy of group function were used as bases for hypotheses concerning expected trends. The second test involved

"good" and "poor" leaders as judged by members. Some of the differences were statistically significant, supporting the legitimacy of the procedure.

A "respondent typology," based on a by-product of the LF analysis of variance, was established, using means and variances of members' responses as categorizing variables. Nine respondent types were given suggestive labels. Using the Minnesota Multiphasic Personality Inventory (MMPI) as a criterion, the typology was tested on three levels: (a) eight hypotheses concerning mean values for selected respondent types on certain MMPI scales were subjected to t-tests; (b) each MMPI scale was subjected to analysis of variance in terms of means of respondent types; (c) the types were tested in terms of a rough index of MMPI profile-similarity. Statistical tests pointed to the existence of some genuine relationships. As the level of generality of the tests ascended, the degree of relationship to the typology became more tenuous.

The basic contributions of the thesis are viewed as methodological:

1. Demonstration of the utility and power of the analysis of variance techniques with sociological data.

2. Development of ways of indicating whether questionnaire responses of group members show sufficient consensus to justify the use of means as group measures.

3. Presentation and test of a group-response adjustment procedure designed to eliminate or reduce the effects of "halo" bias and differential question bias, thus allowing "latent" response patterns to appear and be interpreted.

4. Derivation and test of an objective respondent typology which permits response patterns of group members to be linked to individual personality differences.

283 pages. \$3.54. MicA 55-1515

SOCIOLOGY

SOCIOLOGY, GENERAL

SOCIAL CORRELATES OF THE DIET OF MICHIGAN FARMERS

(Publication No. 12,138)

Jean Krumwiede Boek, Ph.D.
Michigan State University, 1953

In this dissertation the association between social and physiological characteristics of a group and their dietary intake was investigated. Previous work in the social sciences had demonstrated that in human societies the satisfaction of hunger is modified by cultural regulations. Research in nutrition had shown that physiological factors also influence food intake. Findings from both disciplines were utilized, therefore, in selecting characteristics in order to study their relationship to diet.

The specific characteristics chosen for comparison with food intake were level of social interaction as measured by organizational participation and informal participation scores and economic behavior as reflected by a level of living score and income. They included amount of formal training received through schooling, size of household, day of the week food was eaten, and the physiological factors of health, age, and weight. Diet was operationally defined in terms of number of calories, milligrams of ascorbic acid, grams of calcium, and number of foods.

The people studied were 184 men who were heads of farm households in Hillsdale County, Michigan. They were interviewed during four summer months with a schedule of questions designed for coding and machine tabulation of answers. Dietary information was obtained for the entire day prior to that of the interviews.

The general thesis that an association exists between the selected social and physiological characteristics was analyzed through formulating working hypotheses that could be statistically tested. Each hypothesis was concerned with the relationship of one characteristic and a single dietary component. In most hypotheses the direction was a positive one; that is, the postulate was that an increase of the characteristic would be accompanied by an increment in the dietary element. Where an increase in one factor was thought to be associated with a decrease in the other, the direction was considered a negative one.

Thirty-six of the 40 working hypotheses were tested with coefficient of correlation, and six were further examined with correlation ratio. Four hypotheses concerned with day of the week food was eaten were tested with analysis of variance.

Results of the analyses indicated some support for the major hypothesis in terms of direction and significance. Coefficients of correlation were in the same direction as the relationship hypothesized in 30 of the 36 tests. Seven coefficients of correlation and five correlation ratios were statistically significant.

It was found that as organizational participation, informal participation, level of living and income increased the amount of calories, ascorbic acid, calcium and number of foods went up. The relationships for organizational participation and calcium and number of foods were statistically significant at the one percent level. Correlation ratio results for level of living and calories and ascorbic acid were highly significant, while for income and calories the result was significant at the five percent level.

As years of schooling rose, caloric intake diminished whereas ascorbic acid, calcium and number of

foods in the diet went up. The relationship between schooling and calcium intake was highly significant.

As number of members living and eating together in the household became greater, the caloric and calcium intake of the male heads of these households increased while the intake of ascorbic acid and number of foods went down. It had been posited that number of foods would increase as households became larger, but the direction was negative instead of positive. The relationship was found to be a curvilinear one between household size and calcium and number of foods.

As health of the men became increasingly impaired, the intake of ascorbic acid increased and that of calories and calcium diminished. Direction of results for ascorbic acid and calories was opposite of that postulated. In the case of health and calcium the relationship was highly significant.

With advancing age, intake of all four food components went down for the group, with the results for calories and calcium being significant at the one percent level.

Increasing weight of respondents was accompanied by an increment of ascorbic acid content of the diets and a decrease in the other elements. Except for calcium, directions of the coefficients of correlation were opposite of those expected. For weight and calories, greater weight of the men was associated with lowered caloric intakes at a highly significant level.

Tests for day of the week food was eaten were done only for 100 of the farmers. Analysis of variance results indicated that differences of diet between the days were not statistically larger than variation among individuals on the same days. This meant for the group as a whole there were no marked daily differences of food patterns.

184 pages. \$2.30. MicA 55-1516

THE USE OF LEISURE AND ITS RELATION TO SOCIAL STRATIFICATION

(Publication No. 12,166)

Alfred Carpenter Clarke, Ph.D.
The Ohio State University, 1955

This study, concerning the role of leisure behavior in the life-styles of urban individuals, was designed to test a number of largely unverified hypotheses in current sociological literature. It sought to determine the degree to which participation in certain forms of leisure activities is associated with different prestige levels. Some of the issues focused upon were: the extent to which variations occur with regard to (1) active and passive types of leisure, (2) commercial amusements, and (3) the proportion of time devoted to spectator activities. Additional variables dealt with satisfactions derived from spare-time activities in relation to prestige level and the relationship between use of leisure and patterns of occupational mobility.

The design of the study compared leisure patterns

of selected samples of adult males with the relative prestige standing accorded their occupations. Since the study sought to delineate the nature of the relationship existing between different prestige levels and leisure styles, instead of focusing on the stratification system of a particular community, a sampling technique providing equal numbers of cases at different occupational levels was chosen. Cutting points were established along the continuum of North-Hatt occupational scores dividing them into five prestige levels. The total sample of 574 respondents comprised five random samples of approximately equal size. A mailed questionnaire was used for obtaining the data.

Analyses of forty-seven leisure activities indicated that significant differences exist between occupational prestige and leisure use. Differential participation in specific activities, in most instances, varied either directly or inversely with prestige level. Several relationships, however, were curvilinear in nature. Chi square and other tests of significance were employed.

Spectator-type leisure activities did not appear to represent a major proportion of the spare-time activities of male adults. The largest proportion of time devoted to these activities, approximately 40 per cent, occurred at the middle occupational level. This percentage decreased markedly as the upper and lower segments of the prestige continuum were approached.

Commercial forms of recreation seemed to play a relatively minor role in adult leisure patterns. As little as about 4 per cent of the total leisure of persons in the higher prestige group could be included in this category. This amount increased to about 10 per cent for those at the lower prestige level.

A greater proportion of passive activities appeared at each occupational level studied. When the data were classified according to the activities the respondents found most enjoyable, the number of passive activities decreased somewhat at each level.

A majority of the respondents at each level reported deriving either "a great amount" or "a considerable amount" of their enjoyment from their spare-time activities. The percentage who said they obtained only "a fair amount" or "not very much" enjoyment increased as occupational ratings decreased.

The range of leisure activities of the upper, rather than the lower, group was wider and showed more unusual choices.

Participation in organized or formal activities was highest among upwardly mobile persons, while participation in unorganized or informal activities was more frequent among nonmobile and downwardly mobile individuals. A similar pattern appeared when occupational level was held constant.

There is evidence in this study which strengthens the conclusions of earlier research, as well as findings which suggest the emergence of new patterns. Since there are indications from other sources that the amount of leisure is perhaps destined to even more rapid increase in the near future, social scientists and others must eventually recognize that it is

as important to understand the leisure-time aspects of American society as it is to understand the economic, familial, religious, and political aspects.
163 pages. \$2.04. MicA 55-1517

AN EXPLORATORY STUDY
OF THE PREDICTION OF
OCCUPATIONAL ADJUSTMENT

(Publication No. 11,976)

Raymond Oscar Farden, Ph.D.
University of Minnesota, 1954

Advisers: Theodore Caplow and Arnold M. Rose

An ex post facto investigation of factors associated with occupational adjustment. Sample: 83 male graduates of senior high school, Fargo, North Dakota, classes of 1939-1940, residents of that area, interviewed 1950 and data compared with high school record information and other background variables. First chapter reviews literature and discusses methodological problems.

Job Satisfaction as rated by Hoppock Scale was found to be associated with high school class rank, Bell Inventory Social Adjustment Score, years of college, annual income, functional status and prestige of the occupation (Hatt scale). The last three items combined yielded a multiple R of .65 with job satisfaction rating, with functional status having the largest weight. Otis S-A percentiles and ACE Examination percentiles, Bell Emotional Adjustment Scores showed no significant association with J. S. rating.

A job satisfaction profile was obtained for each participant by asking him to plot degree of satisfaction on a prepared form for each year since high school graduation. The average profile began on the "indifferent" level, dipped during period of military service, and rose to the "satisfied" level toward the end of the period. "Smooth" and "Irregular" profile groups could be distinguished, with the latter presenting slightly lower mean satisfaction level, but no background variable used would discriminate between these two groups.

The status of each participant in relation to his fellows in an occupational context was roughly evaluated on a seven-point "functional status scale." Occupational positions of fathers were similarly scored. About 12% of the participants deviated by more than one scale step from the functional status of fathers. Functional status score was found to be significantly associated with Bell Social Adjustment Score and high school class rank, but no stable relationships were found between functional status and Otis or ACE percentiles.

No significant associations were found between rank on annual income and rank on Otis score or high school class rank of the participants.

The five principal occupational groups represented in the sample were professional, managerial-official, sales, clerical and skilled trades. In terms of means only, differences appeared among these groups on income, job mobility rate, job satisfaction rating, years of college, and functional status score. When

tested by analysis of variance observed differences in ACE percentile and class rank percentile was found not to be statistically significant. Differences in Otis score percentiles were very small. Native-born parentage appeared to be associated with "higher" occupational classification.

Crossing of occupational lines (occupational mobility) was observed over a three-generation period and charted. The greatest amount of such mobility was found in the sales and clerical groups and the least in the managerial and skilled trades groups. Of the 54 participants relatively free to make changes (not heirs of businesses) 44% had made such changes. No statistically reliable differences were observed on any background variable with respect to the "Change" and the "No Change" groups.

The mean number of jobs held between 1945-1950 (mobility rate) was 2.17, and no background variable would discriminate between high and low mobility groups.

Occupational choices expressed as high school seniors were predictive of current occupation somewhat more often than not. Occupational entry was stated to be influenced by an average of 17 factors on a check list of 69 items.

Analyses were made of Strong Interest Blank ratings and of the relative rank achieved on Q-score and L-score of the ACE.

The study is believed to support hypotheses of: 1) predictability, 2) developmental process, and 3) relatively greater predictive utility of external as over against internal (psychogenic) factors, in the area of occupational adjustment.

519 pages. \$6.49. MicA 55-1518

NORWAY: A POPULATION STUDY

(Publication No. 12,063)

Anders Steen Lunde, Ph.D.
Columbia University, 1955

Population change in Norway in the past two centuries has accompanied the considerable changes in the socio-economic structure as Norway has moved from a rural and local economy to an urban and nationalized economy. Measurement of this change is made possible by the availability of statistical data from the early 18th Century. Official mortality and fertility statistics date from 1735; the first real census was taken in 1769. Data on emigration are available from 1825 and, since 1947, the continuous registration of the population has made possible for the first time a refined analysis of internal migration.

The earliest known inhabitants of Norway may have settled in Finnmark as early as 15,000 B. C., but by the Bronze Age the basic Norwegian population was established along with social traditions and a way of life observable in contemporary Norwegian culture. Population growth was slow until 1750; from then on its rate of growth exceeded that of Europe taken as a whole. The population was doubled by

1850 and quintupled by 1950. In large measure this was the result of the control of mortality.

For the past one hundred and fifty years the mortality statistics have definitely indicated a declining death rate. Early declines in mortality were associated with the reduction of food shortages and famines while later declines were the result of the direct control over disease and death. Male expectation of life today ranks with the highest in the world while female life expectancy is presently the highest ever recorded for any nation (72.7 years). Norwegian natality declined rapidly in the late 19th and early 20th Centuries. That Norway did not face the consequences of extreme population pressure as found in other European countries was due to two chief factors. The basic population was small and high percentage increases did not result in a large population (the population in 1950 was 3,278,546), and emigration in the 19th Century drained more persons from Norway than were present in the entire population of 1750. Early emigration, however, was directly related to natural increase and the resulting population pressure on the land in a country where only 3 per cent of the total land area is available for agricultural production.

The Industrial Revolution was late in coming to Norway and accelerated population change. A redistribution of the population resulted; the major cities of Oslo, Bergen and Trondheim with their suburban areas rapidly increased in size and dominance. There was a noted growth in agglomerations, especially industrial, in rural districts, as industrialization proceeded. The present internal movement of the population is largely rural-urban but the predominant movement is that from all regions of Norway to the Oslo-area. Østlandet, in which Oslo is located, has become the major industrial region, and in 1950 contained over half of all the industrial workers in Norway. By mid-century also, the largest proportion of persons was supported by industrial employment rather than by agriculture, forestry and fishing. Urbanization brought with it many other changes, notably in family structure. Concern over the change in values and population shifts with their effect on the national economy prompted the government to institute a Regional Plan for Norway, beginning with the reorganization of the Nord-Norge region. It is hoped that the stimulation of industrial development in the under-developed areas within the country will offset the attraction of the large population centers.

544 pages. \$6.80. Mic 55-153

FACTORS RELATED TO OCCUPATIONAL CHOICE OF RURAL FARM MALE HIGH SCHOOL GRADUATES

(Publication No. 11,987)

Keith Nielson McFarland, Ph.D.
University of Minnesota, 1955

This is an exploratory study of the occupational activities in which 453 farm boys were engaged six months after high school graduation. The sample was

comprised of all rural farm boys graduating from public high schools in 1953 in twelve counties in southern Minnesota. The study presented two aspects of the problem: (a) a summary of the occupations chosen and of the students' status in these occupations; and (b), an examination of the ability of certain selected factors to differentiate between farm boys choosing different occupational outlets.

Three major occupational groups were studied. Group I contained 285 graduates who were in some type of farming activity; Group II, 71 graduates employed in nonfarm jobs; and Group III, 97 graduates in fulltime post-high school educational programs.

In the descriptive phase the income status of those in farming was explored, as was the nature of existing partnership arrangements, and the graduates' intentions with respect to continuance in farming. The type of jobs which those in nonfarm jobs held, their location with respect to the farm home, and the future plans of graduates so employed are summarized. The curriculums chosen by those in educational programs were summarized. The institutions attended and their locations with respect to the home farm were described. Post-college or post-vocational school occupational plans are presented. Expressions of job satisfaction in the three groups were compared.

In the analytical phase the three occupational groups were distributed on the basis of twenty-two selected factors. These included such factors as the size and nature of home farm operations, the graduates' activity in establishing farming programs of their own, and their activity in various rural youth groups. Socio-economic characteristics of farm boys' home farms and families were assessed, and measures of the academic aptitude and achievement of the graduates were secured. The homogeneity of the distributions of the three occupational groups with respect to each of these factors was tested through the use of the chi square test and the analysis of variance.

Post-high school occupational activities chosen by graduates appeared to be influenced by a complex of factors. Among factors differentiating at significant levels among the three major occupational choice groups were:

- a) Measures of the size of home farm programs in acres and work units.
- b) Student's investment in machinery and equipment, and his participation in management of the home farm program.
- c) Factors related to level of living of the farm family.
- d) Ages of parents, and their levels of education.
- e) Levels of education of older brothers, and their occupations.
- f) Certain nationality group backgrounds.
- g) Amount of vocational agriculture taken in high school, and participation in 4-H Club activities.
- h) Measures of academic aptitude and achievement.

Interrelationships among the selected factors suggest that three general measures may have promise for use in predicting occupational choice of rural farm male high school graduates. These include (a) a general measure of size of the home farm business, (b) a measure of the "agricultural activity" of the farm boy, and (c) a measure of his academic aptitude and achievement.

238 pages. \$2.98. MicA 55-1519

A CRITICAL REVIEW OF THE RESEARCH IN RURAL SOCIOLOGY

(Publication No. 11,991)

Ann Garver Olmsted, Ph.D.
University of Minnesota, 1954

Adviser: Lowry Nelson

The study is an attempt to assess the development and achievements in the field of rural sociology over its forty year history. The major justification for a study of this sort is that the social sciences, unlike the more highly developed branches of science have not yet developed the mechanics of self-correction. Thus, there is consciously felt the need for critical review. It is this function that this work is designed to fulfill.

However, as the field is one of many facets, only a portion of the total field of rural sociology may be conveniently handled in a single work. The aspects of the total field of rural sociology upon which this work focuses are the social relations, social organization, and social institutions of the rural community, for it is in the research in these areas that the rural sociologist functions as a behavioral social scientist.

Specifically, the questions for which answers are sought are the following: 1) what have been the major lines of development in the field of rural sociology as shown by the research produced in the field? 2) given this knowledge what may be inferred to be some of the alternative courses of future development?

By way of summarizing the body of the thesis, it should be noted that in the main American science has been highly pragmatic. Moreover, in the physical sciences until very recently there has been espoused a set of beliefs which were in essence that science, over the long run, works to the advantage of humanity, but that in any given application of a scientific finding, it is not appropriate for the scientist to judge the suitability of the application. Conversely, the origins of American social science are rooted in reform. It has only been in more recent years that the social scientist has come to espouse the value-free position of the physical scientist.

As the social research arm of the U. S. Department of Agriculture, the rural sociologist has had a more difficult time achieving both a value-free position and as well having available to him the facilities and resources for building a body of scientific knowledge. Thus, rural sociology has for many years relied on the descriptive study of the individual

community, its institutions, and its social relationships, as this was the best technique available for providing information that had immediate practicality.

It is only since the later part of the 1930's that the rural sociologist has been concerned with providing answers of wider applicability, which in turn implies the need for attention being turned to basic research. Increasingly, the rural sociologist is concerned with basic research as he becomes more and more aware that what he is studying is American society in all of its complexities rather than the simple rural community of a generation or two ago.

Further, it seems evident that the differences between the rural and urban modes of life are rapidly decreasing, so that the rural sociologist, when studying organizational and behavioral aspects, can profitably pool his efforts with those of the general sociologist or with colleagues from the other social sciences, rather than continuing to study an artificially defined segment of the society.

Alternatively, the transplanting of American technology abroad provides him with a new and fertile field for research. The rural sociologist's recently increased interest in theory and methodology strongly suggest that he may be able to do a much better job of providing practical answers to problems of change in other cultures than he has been in providing answers to such problems as they have arisen in his own culture.

353 pages. \$4.41. MicA 55-1520

SOCIOLOGY, FAMILY

SEX ROLE AND SELF CONCEPT; A STUDY OF THE FEMININE SEX ROLE AS PERCEIVED BY EIGHTY-FIVE COLLEGE WOMEN FOR THEMSELVES, THEIR IDEAL WOMAN, THE AVERAGE WOMAN AND MEN'S IDEAL WOMAN

(Publication No. 11,901)

Alexandra Botwinik Fand, Ph.D.
Cornell University, 1955

Given the fact that we do not have today a generally accepted definition of woman's role in the modern world, this study proposes to explore some of the factors which account for the differences between women with various ideas on their place in society and in the home.

The basic hypothesis which this study attempts to verify is that the choice each woman makes between a traditional and a progressive concept of the feminine role - and combinations thereof - depends upon her self concept.

A woman is defined as "Other-oriented" when she embraces a traditional attitude toward the feminine role and conceives of herself primarily as the counterpart, the "Other" of the man and children in her life, realizing herself indirectly by fostering their

fulfillment. A woman is defined as "Self-oriented" if she has a liberal concept of the feminine role, embraces the main achieving orientation of our culture, and strives to fulfill herself directly by realizing her own potentialities.

A rating-inventory composed of thirty-four statements bearing on women's needs, rights, and obligations was constructed to measure the attitudes of the subjects (85 freshmen in the College of Home Economics) toward the feminine sex role and record them on a continuum. This rating inventory was submitted four different times to the subjects, each time with different instructions. First they were asked to respond to the items, giving their own true opinions; second, they were asked to respond the way their "Ideal Woman" would; third, the way they thought the "Average Woman" would; last, the way they believed "Men's Ideal Woman" would respond to the items.

Four different scores were calculated for each subject. The score based on their own opinions was used to situate each individual woman on the continuum comprised between Self- and Other-orientation. The other three scores were used as correlates of the first, to indicate the degree of the subjects' feeling of personal adequacy and of the relatedness they experience with the world of men and women around them.

Together with the rating inventory, the subjects were asked to fill out a demographic questionnaire which furnished some longitudinal data. In addition, each student handed in an autobiographic essay. Eighteen of the subjects were interviewed.

The statistical analysis of the numeric data indicated:

As a group, the 85 college women see the feminine sex role as combining an approximately equal amount of Other- and Self-oriented elements. They perceive the Ideal Woman as having an attitude markedly similar to their own. The Average Woman is seen to be significantly more Other-oriented than themselves or their Ideal Woman. Men's Ideal Woman is seen as highly Other-oriented, and thus different, not only from themselves and their Ideal Woman but even from the Average Woman.

The distribution of the 85 subjects according to their own opinions lent itself to division into six distinct groups. The relationship between the mean scores obtained on the Own Self, the Ideal Woman, the Average Woman, and Men's Ideal Woman presented a different pattern for each of the six groups.

Thus, for instance, the most Other-oriented subjects perceive the Average Woman to be a Self-oriented, while the most Self-oriented subjects perceive her to be Other-oriented; in other words, the subjects who hold relatively extreme views on the feminine role feel themselves as most different from the Average Woman.

Also, the mean scores of the six groups on Men's Ideal Woman fall into a curvilinear distribution, with both the most Other-oriented and the most Self-oriented subjects estimating Men's Ideal Woman to be highly Other-oriented; the first believe themselves to be a close approximation of what men want, the latter see themselves as exactly the opposite.

In addition to the statistical findings, the clinical analysis of representative cases from each of the six groups supports the hypothesis that a woman's self-concept plays a determining part in her choice of a certain version of the feminine role.

Of the background factors, the following seemed to be differentiating: Happiness of family life, position in the family constellation, parents' educational and economic status, religion, and size of home community. 144 pages. \$1.80. MicA 55-1521

FAMILY RELATIONSHIPS AS VIEWED BY TEENAGERS

(Publication No. 11,678)

Stanley Earl Fowler, Ph.D.
The Florida State University, 1955

This investigation lies in the general area of adolescent attitudes toward a range of family relationships.

The purpose of the study was threefold: (1) To ascertain the degree to which a selected group of teenagers agree with 54 family relationships items; (2) To determine to what extent these teenagers hold attitudes conducive to the establishment or maintenance of traditional, developmental, or anarchistic family living patterns; and (3) To discover to what extent agreement varies by sex and age of the respondents and by the social status of their families when the McGuire-White Index of Social Status (Short Form) is used as a measure of socio-economic status.

Data were collected by means of a questionnaire administered by the investigator to 1293 in-school white youth in three north Florida counties. A relatively homogeneous group of 572 teenagers was selected according to previously established criteria. Subjects' responses to the 54 selected family relationships items were analyzed by percentage of agreement. Differences in agreement between boys and girls, younger and older youth, and middle and lower socio-economic classes were examined for significance by use of chi-square. Differences were analyzed for significance within the family life styles defined as: (1) Traditional-Autocratic-Authoritarian, (2) Developmental-Democratic-Equalitarian, and (3) Anarchistic-Individualistic-Laissez Faire.

Seventy-five per cent or more of the subjects agreed with 19 of the 54 items in the schedule. Fifty through 74 per cent expressed agreement with 17; 25 through 49 per cent expressed agreement with 11; and less than 25 per cent agreed with the remaining 7 items. Thirteen of the 14 items classified as developmental by a panel of professional personnel in the field of marriage and family living were in the two highest groups. Only 12 of the 19 traditional items and 6 of the 14 anarchistic items were in these high agreement categories.

Sixty per cent of the 572 subjects in this study expressed agreement with the schedule items when these items were taken as a group. Eighty-one per cent

expressed agreement with items classified as developmental, 57 per cent with items classified as traditional, and 43 per cent agreed with items classified as anarchistic. No significant variations were found between the responses of the boys and girls, younger and older adolescents, and between socio-economic classes to the total group of items pertaining to any of the three specified family life styles. Significant differences were found when responses to individual items were analyzed. Twenty-five showed significant differences between responses of boys and girls, 15 showed significant differences between younger and older, and 8 showed greater than chance differences between middle and lower socio-economic classes at the 5 per cent or higher level of significance.

Of greater moment than the specific differences found between groups classified as in this study is the indication that a group of teenage students will hold varying attitudes toward a wide range of family relationships. It would seem important, therefore, that teachers, guidance workers, and others dealing with family life situations in their work with adolescents and their parents to recognize that such differences in attitudes may exist and that they institute some means of discovering what the differences are for their particular group. If the gap between parents and their teenagers is to be lessened, and if the aim of greater understanding and satisfaction in family living is to be realized, family life workers will need to survey the attitudes of parents as well as those of the adolescents. Only in so far as the total picture is seen can the most effective planning and teaching be carried out. 107 pages. \$1.34. MicA 55-1522

SOCIOLOGY, RACE QUESTION

A COMPARATIVE ANALYSIS OF THE OCCUPATIONAL ASPIRATIONS OF RURAL AND URBAN NEGRO ADOLESCENTS

(Publication No. 12,119)

Earl Hamilton Pierro, Ph.D.
State University of Iowa, 1955

Co-Chairmen: Professor Harold W. Saunders
Associate Professor Manford H. Kuhn

This research project investigated some factors associated with the occupational aspirations of Negro adolescent males in selected regions of Georgia. The guiding assumption of the research was that the determinants of occupational aspiration could be located in the social systems within which the individual feels he participates.

Among the hypotheses tested were the following:

1. the association of primary group sourced statements and aspirations to teach.
2. the association of primary group sourced statements and occupational choices suggested by the teacher.

3. association of rural-urban residence to brick masons as an occupation.

4. association of secondary group sourced occupational models and "unrealistic" income expectations.

5. the association of secondary group sourced occupational models and aspirations to purchase expensive automobiles.

6. the association of primary-secondary group sourced occupational models and psychic-real money income expectations.

7. association of primary group sourced occupational models and suggested occupation by the mother.

8. the association of rural-urban residence and education as a barrier to successful job choice.

9. association of parental education and professional occupational aspirations.

10. association of occupational aspiration of respondent to occupational aspiration of one's best friend.

The sample consisted of 144 cases drawn randomly from the universes of four high schools in Georgia, with the areas surrounding the four high schools varying along the rural-urban continuum. An additional sample of 80 white adolescent males was utilized for a preliminary study of possible dissimilarities between the white and the Negro adolescent in comparable areas.

The statistical techniques utilized to test the hypotheses were the Chi-square test for presence of association and Q for degree of association.

The findings on tests of the null hypotheses were as follows:

- No. 1. rejected at the 5% level for total sample
- No. 2. rejected at the 5% level for total sample
- No. 3. rejected at the 5% level
- No. 4. rejected at the 5% level for total sample, rural sample, but not for urban sample
- No. 5. rejected at 5% level for total sample
- No. 6. rejected at the 5% level for total sample
- No. 7. no significant relationships in the total sample or any subdivision of the sample
- No. 8. rejected at the 5% level for total sample
- No. 9. no significant relationship for total sample, but urban-only sample approached significance
- No. 10. no significant relationship for rural-only sample; for the urban-only sample, rejected at 5% level.

The exploratory study presents preliminary evidence supporting the merit of studying occupational aspirations within the context of social structure, i.e., reference groups and categories, primary and secondary group associations, etc. Although the present study was circumscribed in many ways, future research (involving both replication and tests of other related hypotheses) would appear to be productive to theory development in the social sciences in general, and in the area of occupational aspirations particularly.

109 pages. \$1.36. MicA 55-1523

**THE ROLE OF NEGRO PRESSURE GROUPS
IN INTERRACIAL INTEGRATION IN
DURHAM CITY, NORTH CAROLINA**

(Publication No. 11,948)

Alphonso Stewart Powe, Ph.D.
New York University, 1954

This study is a description and analysis of the activities of six Negro pressure groups in the interracial picture in an urban industrial community in North Carolina.

The basic assumptions of interracial integration as used here are changes in the direction of consensus of the community respecting values, parity in economic opportunities, educational privileges, and political participation.

Durham is in the center of the South Atlantic region. It is the county seat, and the county's only city.

Both its Negro and White populations have grown steadily since the turn of the century. In this community both of the races tend to live in racial communities within the larger whole. Negro society is broken down into three groups: a small upper class of white collar workers; a middle class of craftsmen, foremen and kindred workers, and operators and kindred workers; and a large lower class of service workers, domestic service workers and laborers.

Economic trends measured in terms of bi-racial employment show an increase for Negroes in municipal jobs. Political trends marked by registration and voting records showed a decided increase in Negro civic activity. Provisions of public facilities exhibited in subscriptions to light and water meters along with expenditures for school equipment showed changes favorable to Negroes; and consensus respecting community values as seen in the reduction of the felonious crime rate for Negroes in the community during the past decade as well as the contributions of Negroes to the Community Chest and the Chest's allocation to Negro organizations showed changes in the direction of unity and cooperation of the two races.

The six groups chosen for study from a large number of various kinds of associations were: The Durham Committee on Negro Affairs, The Durham Business and Professional Chain, Local 208 Tobacco Workers, The Interdenominational Ministerial Alliance, the Colored P.T.A. Council, and the Durham branch of the N.A.A.C.P. For each organization questions were raised concerning the following: (1) life history, (2) meetings, (3) leadership, (4) activities, (5) techniques, and (7) literature.

With two exceptions, the groups studied were organized since 1930. All had been very active for wider participation of Negroes in community affairs since the early 1940's, and all exhibited similar patterns of behavior in race relations.

The activities of these groups were reduced to the following patterns of action: exhortation to goodwill, education, participation, negotiation, contention, and prevention. These patterns were then put on a scale ranging from most effective in interracial integration, to most ineffective, and presented to the thirty leaders of the six groups. Out of 210 scored, 207 fell on the positive side of the scale. Ten longtime residents scored seventy out of seventy positive, and ten social scientists scored sixty-eight out of seventy positive.

The opinions of these people in the environs of the problem were not taken as criteria as to how the behavior of these groups did or did not affect changes. But the value judgments of these people in the environs of a social problem can by no means be ignored as a basis for analysis. It seems reasonable to assume that along with the era of prosperity in which the favorable changes occurred, the national emphasis upon the fulfillment of the principles of democracy in order to combat Communism, the activities of these organizations were also significantly related to these changes.

It is hoped that through the study of the organizations and activities of these Negro pressure groups in an urban industrial community of the South, the strength and weakness of such associations might be set forth in concrete examples.

193 pages. \$2.41. MicA 55-1524

SPEECH - THEATER

THE THEATRE CRITICISM OF JAMES AGATE

(Publication No. 11,486)

Leighton Milton Ballew, Ph.D.
University of Illinois, 1955

The purpose of this study is to discover and state the critical theory of James Evershed Agate, to compare his theory with his actual practice, and to relate his dramatic criticism to the British theatre during the first half of the twentieth century.

The source materials include all of the published works of Agate that are concerned with dramatic

criticism. Fifty books by Agate and twenty-three magazine articles by or about Agate have been used, including some material that is not related to drama and theatre.

The analysis of this material consists of formulating Agate's theories about dramatic criticism, plays, playwrights, and the elements of production. These theories are compared with his actual practice as evidenced in his reviews.

The first chapter outlines his background and the early influences on Agate, including the theatre he saw in his youth and his apprenticeship as a critic. The second chapter presents his concept of theatre,

his critical theory, and critical method. The third chapter is concerned with Agate's criticism of various types and styles of drama, including specific comments on particular plays and playwrights. The fourth chapter presents his theories regarding the elements of production: the place of acting, scenery, costume, music, and direction in the theatre. Chapter five is concerned with his comments on actors and acting, the area, probably, in which Agate made his most significant contribution.

His father's influence and his early experiences in the theatre formed Agate's ideas about the greatness of Henry Irving, the inadequacy of "intellectual" theatre and "intellectual" acting, and the importance of "temperament" in acting, ideas which pervaded his dramatic criticism.

Agate believes that dramatic criticism is entirely personal and subjective and this belief is reflected in his impressionistic method. According to Agate, dramatic criticism has two primary functions: to serve as a guide for the ordinary theatregoer and to record acting and actors for posterity. His concept of the dual role of the critic as spectator and reviewer is unique and entirely his own. Because he sees all plays in terms of theatre rather than literature, he regards the elements of production as important and concentrates his attention on the emotional impact of the production on the audience. Agate endorses simplified staging with reservations. He believes in simplified representational theatre production and in the proscenium arch stage because it gives more "illusion" than any other. He rejects formalized staging, the apron stage, and replica staging - attempts to reproduce in detail the production methods of past times.

Although he recognizes the contribution of scenery, costume, music, and direction to theatre, Agate believes that acting is the most significant and important element of theatre art. He never altered his conviction that the great actor would be just as great in any period and that the director constitutes the chief threat to the virtuoso actor.

In theory, he disapproves of expressionism, expressionistic staging, "intellectual" theatre, and amateur societies. However, in his actual practice, he gives favorable reviews to several expressionistic plays, expressionistic staging techniques, and many productions of the Oxford University Dramatic Society. He did not ignore the emotional impact of these plays and productions on the audience.

Agate may be termed a "transitional" dramatic critic who retained many nineteenth-century concepts of drama and theatre but, in spite of his convictions, admired some new plays, new playwrights, and new techniques of theatre production. The inconsistencies between his theory and practice reflect the transitions that were taking place in the theatre of his time, particularly the change from virtuoso to ensemble acting. Perhaps, because his approach to theatre criticism was subjective and anti-intellectual, Agate's contribution to the theory of dramatic art is not remarkable, but his seven million words of dramatic criticism filled with detailed accounts and analyses of the great acting of the late nineteenth and

early twentieth centuries constitute a mine of information for students of English theatre history.
186 pages. \$2.33. MicA 55-1525

A RHETORICAL ANALYSIS OF THE PUBLIC SPEAKING OF RICHARD F. PETTIGREW

(Publication No. 11,969)

Alphus Rolland Christensen, Ph.D.
University of Minnesota, 1954

The purpose of this study was to examine and analyze the career of Richard Franklin Pettigrew as a public speaker, to determine the principal lines of argument which he advanced and to determine the rhetorical methods which he employed. These four factors were considered; the man himself and the influences which tended to shape his development, physique, habits, skills, reputation and the persons, activities, institutions, and situations affecting him and his reputation as a speaker; the occasion, with particular reference to the time, the place, and the rhetorical implications of the social setting; the audience to whom the speech was addressed, including not only the audience within the sound of the speaker's voice but also the more remote reading audience; finally, the speech itself, with attention to invention, arrangement, style and delivery. Speeches, letters, diaries, magazine and newspaper accounts plus seven taped interviews provided most of the material used in the study; the persons interviewed had been personally acquainted with Mr. Pettigrew.

Coming to the Territory of Dakota in 1870, Pettigrew, as a young man, soon established himself as a westerner. Extremely active in business and politics, Pettigrew played an important part in securing statehood in 1889. It seemed natural that he be chosen as one of the two senators. Although he was elected a senator just nineteen years after he had come to Dakota, he was wealthy enough to charter a special train for his triumphant return to his home city, Sioux Falls. From this time until he broke with the Republicans in 1896 at St. Louis, he controlled the politics of the state. The schism was not too surprising since Pettigrew placed principle above party.

Pettigrew was a westerner; he represented a region plagued with drouth, grasshoppers and little money. He responded to the needs of the people; he sought solutions to the problems of the frontier. Except for campaigning, most of Pettigrew's speaking was in the Senate; here, he participated in the give-and-take of running debate. Since he was a Senator and an advocate of "free silver," many audiences desired to hear him.

Apparently Mr. Pettigrew wanted to improve his ability as a speaker for he worked at it. Early in his life he sought out those social contacts which would help him; he accepted every opportunity to speak. He read widely and traveled much. Although he did some speaking from manuscript and although senatorial debate gave him practice in impromptu speaking, he preferred to speak extemporaneously. Because of his

ability to remember, Pettigrew seldom used notes. Two ideas, imperialism and exploitation, were found to be expressed in most of his speaking - whether it was a speech against the annexation of Hawaii, against the acquisition of the Philippines, a plea for government ownership of the railroads, or the "cry for free silver."

Three speeches, congressional, campaign and a Labor Day address, were selected for individual rhetorical analysis. These were outlined and analyzed as to logical, emotional and ethical proof, arrangement and style. Pettigrew believed that logical proof was the most important constituent of argumentative discourse. Argument from authority, statistics, generalization and condition were employed most often. Emotional appeals were subordinated to the logical elements in his speeches; generally, these were used sparingly and seldom in his congressional speaking. His record of character, competence, intellectual integrity and wisdom constituted a strong ethical argument. He relied primarily on the presentation of an argument supported by adequate evidence. During his career he was regarded as "one of the ablest debaters in the Senate."

375 pages. \$4.69. MicA 55-1526

THE EFFECT OF ALTERED EXTERNAL SIDE-TONE TRANSMISSION TIME UPON ORAL READING RATE, PRECISION OF ARTICULATION, AND PITCH VARIABILITY

(Publication No. 12,168)

Grover Donald Davidson, Ph.D.
The Ohio State University, 1955

The purpose of this study was to investigate the effects on certain speech characteristics of variations in external side-tone transmission time. The delay times used were 0.0005, 0.0010, and 0.0015 second. The specific characteristics of speech studied under the above experimental conditions were as follows: a) the oral reading rate of five five-syllable phrases; b) the precision of articulation as measured by listener scores on the POS Multiple-Choice Intelligibility Test; and c) pitch variability as demonstrated by the number, the mean extent, and the mean rate of inflection in a sentence selected from the oral reading of the passage Navy. A related problem was to determine whether adaptation in reading rate occurs after a brief period of vocalization of 30 seconds under a given side-tone delay time longer or shorter than normal delay time. That is, the question to be answered is whether a deviation from normal reading rate during the first five seconds under an abnormal delay condition decreases after 30 seconds of continuous reading under that condition.

Twenty-four males of college age read the five five-syllable phrases, the passage Navy, and the five five-syllable phrases a second time under each of the three side-tone conditions. In addition, eight of the 24 subjects read three Speaker Lists from the

POS Multiple-Choice Intelligibility Test, one list under each of the experimental conditions. All vocal responses were recorded on tape. The duration of reading for the five five-syllable phrases was determined from power level recorder tracings of the recorded responses. The recorded intelligibility test was played in noise to a panel of 23 listeners. From the reading of the passage Navy, a sentence was selected to be analyzed for the number, the mean extent, and the mean rate of inflections.

Results of the analysis of the data may be summarized as follows:

1. As the external side-tone delay was varied from 0.0015 second to 0.0010 second to 0.0005 second, the mean duration of reading of five-syllable phrases was reduced significantly by approximately 0.02 second per phrase with each change in side-tone delay.

2. The observed adaptation under the longer delay might be the result of practice effect. Adaptation of reading rate toward the rate under normal delay took place under the longer, but not under the shorter, delay. Change in rate for the shorter delay was opposite to prediction under the hypothesis of adaptation. Rate increased under all delay conditions.

3. Precision of articulation as measured by scores on the POS Multiple-Choice Intelligibility Test did not vary significantly for the side-tone transmission times used in this experiment.

4. The number of inflections used by the experimental speakers did not vary significantly under the three experimental side-tone conditions.

5. The extent of inflection was significantly greater for the side-tone delay of 0.0005 second than for the delays of 0.0010 and 0.0015 second. There was no significant difference in extent of inflection between the delays of 0.0010 and 0.0015 second.

6. The mean rate of inflection was significantly greater for the side-tone delay of 0.0005 second than for the delays of 0.0010 and 0.0015 second. There was no significant difference in the mean rate of inflection between the delays of 0.0010 and 0.0015 second.

63 pages. \$1.00. MicA 55-1527

THE EFFECT OF STATIC AIR PRESSURE IN THE EXTERNAL AUDITORY MEATUS ON HEARING ACUITY

(Publication No. 12,032)

Ronald Gordon Hansen, Ph.D.
The Ohio State University, 1954

Adviser: Dorothy H. Sherman

The main purpose of the present study was to test the hypothesis that static air pressure in the auditory meatus affects hearing acuity. The specific purposes were to determine the effects of pressure on (1) threshold sensitivity, (2) hearing acuity at two loudness levels above threshold, and (3) speech intelligibility.

The particular pressures chosen for each experiment were +10, +20, -10, and -20 cm H₂O. There

were two sources of pressure: (1) An air compressor for the positive pressures, and (2) a vacuum pump for negative pressures. Two valves and two water manometers were used to control and measure both negative and positive pressure. An earpiece fitted airtightly over the external ear presented the pressure to the external auditory meatus.

For the threshold sensitivity experiment, frequencies at 100 cps intervals from 100 cps to 4000 cps, at 6000 and at 8000 cps were selected. Each tone was automatically on for two seconds and off for two seconds alternately. The subjects found their own threshold by adjusting an attenuator set. Criterion measures were the deviations in db of each pressure-frequency combination from the corresponding frequency threshold determined under zero pressure. Criterion measures were obtained for 10 ears at each of 41 frequencies at each of four pressure conditions, 1640 measures. The interaction between pressure and frequency was significant, indicating that the relative differences among frequencies vary from pressure to pressure and the relative differences among pressures vary from frequency to frequency. Threshold sensitivity was generally decreased from 5 to 12 db for frequencies below 1500 cps for the +10, +20, -20 cm H₂O pressure conditions. The -10 cm H₂O pressure appears to have very little effect on threshold sensitivity in the same frequency range. In the frequency range from 1500 to 2300 cps the +10, -10, -20 cm H₂O pressure conditions increase sensitivity slightly. Sensitivity for frequencies above 2300 cps was only slightly affected by pressure.

To test the effect of pressure on hearing acuity at different loudness reference levels five subjects made equal loudness balance judgments for six frequencies (200, 400, 1000, 1600, and 4000 cps) at 30 db and at 60 db above threshold under each of the four experimental pressures. Thresholds for the above frequencies were also determined. The subjects adjusted an attenuator set in making the equal loudness balance judgments. Criterion measures were the deviations in db of attenuation of frequency under each pressure condition from the corresponding judgments under the zero pressure condition. Criterion measures were obtained for five subjects at three loudness reference levels at six frequencies at each of the four experimental pressure conditions. As in the threshold sensitivity study there was a significant interaction between pressure and frequency. Sensitivity for the lower frequencies 200, 400, and 1000 cps was generally decreased from 5 to 10 db for all three loudness reference levels for the +10, +20 and -20 cm of H₂O pressure conditions. The -10 cm pressure condition had little effect on this frequency range. The three upper frequencies of 1600, 2000, and 4000 cps were only slightly affected by the several pressure conditions. Loudness levels did not interact with any other factor. Loudness levels were not significantly different with respect to sensitivity. A slight decrease in sensitivity, however, appeared to accompany an increase in loudness.

To test the effect of pressure on listening to speech, the responses of 10 subjects to two speech intelligibility lists under each of five pressure

conditions were obtained. A tape recording of the Multiple-Choice Intelligibility Test, Form C was played to each subject under the several pressure conditions. The speech signal was presented to the subject at an average peak level of 80 db simultaneously with a white noise of 76 db. The criterion measure was the number of errors for a pair of speaker lists for one subject under one pressure condition. An analysis of the data provided no evidence that the pressure conditions of this study have any effect upon listening ability as measured by the Multiple-Choice Intelligibility Test, Form C.

86 pages. \$1.08. MicA 55-1528

THE SACRAMENTO THEATRE, 1849-1885

(Publication No. 12,268)

Charles Vernard Hume, Ph.D.
Stanford University, 1955

The discovery of gold in California brought thousands of men to the gateway of the gold fields - Sacramento. The demand by these Argonauts for entertainment prompted the construction of the Eagle Theatre and the organization of the first professional acting company in the West. From its beginnings in this pioneer theatre, there developed one of the most colorful and interesting theatre programs in the gold region.

This work chronicles the first thirty-five years of Sacramento's theatrical history and encompasses a period when stock companies flourished in the city. By interpreting public response and critical reviews of the theatre programs, this detailed account endeavors to reflect the cultural status of the frontier community as well as to illustrate the changing picture of theatrical activity.

A majority of the theatrical "stars" of the period made the trek to California and contributed to the array of talent that crossed Sacramento's stages. Junius Brutus Booth, Edwin Booth, Frank Chanfrau, Laura Keane, Frank Mayo, Lotta Crabtree, James A. Herne, Dion Boucicault, Adah Menken, David Belasco, Maude Adams, Lola Montez, and scores of other famous troupers appeared in Sacramento during the early period.

This study has been organized in terms of the theatres that flourished during the period: the Eagle, the Tehama, the Pacific, the American, the Sacramento, the Forrest, the National, and the Metropolitan. For each of the theatres an attempt has been made to describe its physical appearance, to give a detailed picture of the companies to play there and their repertoires, and to interpret the reception given these plays by the audience. Later sections deal with the transition from the resident stock companies to the traveling companies, the minor theatre activities in the city, and the amateur performances during the early period. Throughout the work an attempt has been made to evaluate the cultural and social contribution of the theatre to Sacramento.

This appendix includes a chronological table of

of important theatre events, and a chronological table of the plays produced in Sacramento during the period covered.

504 pages. \$6.30. MicA 55-1529

AN ANALYSIS OF INVENTION IN THE
1952 PRESIDENTIAL CAMPAIGN
ADDRESSES OF DWIGHT D. EISENHOWER
AND ADLAI E. STEVENSON

(Publication No. 12,122)

Malcolm Osgood Sillars, Jr., Ph.D.
State University of Iowa, 1955

Chairman: Professor A. C. Baird

The writer of this study examined seventy-one Eisenhower and one hundred forty-four Stevenson speeches to evaluate the invention of those men in the 1952 presidential campaign. This involved the examination of the background, audience, issues, organization, speech composition and the development of the three forms of proof - logical, emotional and ethical.

Background to the Campaign

Through congressional investigations and the charges of such men as Senator Joseph McCarthy, the question of corruption and communism in government became a significant issue by election time. The nation enjoyed domestic prosperity under the Democrats but there was also inflation, with its effect on that prosperity. In addition, questions of social welfare, agriculture, labor, offshore oil, the McCarran Act and public power developed within the domestic economy issue. Foreign policy had become an issue through the defeat of Nationalist China, the Korean war, the "Great Debate" and the Mac Arthur dismissal.

The previous socio-economic divisions of the new electorate along party lines were not so strong although still important, in 1952, as they had been previously. The normally Democratic voting groups - the poorer, less educated, manual working, later immigrant and Negro groups - were, because of prosperity, moving in increasing numbers into the middle-class where they were subject to Republican cross pressures.

While the majority of the American people agreed with the Democratic policies they were dissatisfied with the then present conditions. Eisenhower was a popular figure with them, whereas Stevenson was practically unknown.

The Issues

There were some specific disagreements between the candidates on policy, as on civil rights, the Taft-Hartley law and offshore oil, but in general the campaign was not fought over the policy to be followed. Eisenhower chose to devote the bulk of his attack, on all three issues, to the leadership provided by the

Truman Administration. He accepted many of the Democrat policies. Stevenson defended the Administration and charged that it was Republicans who had hampered effective leadership.

The Proofs

Eisenhower's basic premises reflected the optimism about man characterized by nineteenth century business liberalism. He saw leadership as America's only need. Stevenson reflected the contemporary intellectual pessimism about man and progress. This pessimism established Stevenson as a more conservative person than Eisenhower, though still a liberal.

Both candidates preferred reasoning by generalization. Both tended to assert rather than prove, avoid refutation and use rather weak causal reasoning. All of these weaknesses were more evident in Eisenhower than in Stevenson.

The emotional proof of both speakers was well adapted to their arguments and the audience. Eisenhower used the hostility motive primarily and Stevenson used ego-expansion.

While Stevenson brought out his varied background in civil service and in other ways pictured himself as an intelligent and experienced public servant, Eisenhower concentrated for his ethical proof on his war experience.

Non-Invention Factors

Both speakers, but especially Eisenhower, were weak in speech organization. Both too often merely made statements as though for press release rather than oral delivery. Further, the speeches were weak in organization as they were weak in invention. Lack of support left no blocks of material to organize.

Stevenson chose as his assistants research men and college professors. Eisenhower chose successful writers from leading magazines. Stevenson preferred to speak from prepared text and Eisenhower preferred to speak from notes.

Conclusions

Those who voted for Eisenhower were agreed on only one thing - their candidate. Those who voted for Stevenson were united on issue and party (to an unusual extent). Eisenhower's tactics of pushing the question to that of his own personal popularity apparently paid off in votes. Stevenson's emphasis on the ideas of the campaign apparently succeeded in educating a considerable segment of the voting population. Stevenson, more than Eisenhower, met the tests of the rhetorical critic.

377 pages. \$4.71. Mic 55-154

**GASTON BATY: THEORIST
OF THEATER ARTS**

(Publication No. 12,070)

Arthur Simon, Ph.D.
Columbia University, 1955

Gaston Baty (1885-1952) was primarily a stage director. He was also a writer and theorist on theatrical arts, an historian, playwright and adapter. This dissertation treats his work as a writer and theorist.

This dissertation is divided into three parts. Part One is a chronological account of Baty's life and achievements, starting with the earliest influences which played upon him in his environment and education. A native of Lyon, he came to love the theater through a love for the local Guignol marionettes. At the University of Lyon he studied art and design. At the University of Munich he studied seventeenth-century German literature and the influence of Shakespeare in Germany. He was impressed by the German romantic movement. Travel acquainted him with the work of Max Reinhardt and Constantine Stanislavsky. He also knew the theories of Gordon Craig and Adolphe Appia. He considered significant the work of Fritz Erler and Georg Fuchs at the Munich Kunstler Theater.

Baty's early associates in Paris were Firmin Gémier and the playwright, Saint-Georges de Bouhélier. After serving an apprenticeship with Gémier, Baty founded a short-lived theater, *La Baraque de la Chimère*. With the closing of the *Baraque*, Baty was offered the use of the Studio des Champs-Élysées by Jacques Hébertot, and from the Studio Baty wandered from stage to stage in Paris until 1930 when he settled down in the Théâtre Montparnasse.

In 1936, Baty and Charles Dullin, Louis Jouvet and Georges Pitoëff, known as the Cartel des Quatre, were called to direct productions at the Comédie Française. Many of Baty's efforts aroused lively controversy. In 1947 he quit the Montparnasse and, while continuing to stage productions elsewhere and to promote a theatrical revival in southeastern France, he concentrated his attention upon his life-long love, the

marionette theater. A progressively declining state of health led to his death in October 1952.

Part Two treats Baty's adaptations and his theories. His *Crime et châtiment* is compared with the Dostoyevsky novel and with a previous adaptation written by Georg Schdanoff and Viktor Trivas. Aspects of his writing methods are drawn from the prompt-book of the play. Baty's *Madame Bovary* incurred the wrath of Flaubertians by his omission of the first half of the novel. His *Emma's* dullness was counteracted by the excellent interpretation of the role by his leading lady, Marguerite Jamois. In *Dulcinée*, inspired by an episode in *Don Quixote*, one finds Baty's most original dramatic work. With *La Passion* and *Blancheneige*, dramas of his youth, a trait common to all Baty's plays is revealed: the theme that man is redeemed through suffering and turning to love of man and God.

Baty's theories stem from Catholic doctrine and particularly from St. Thomas Aquinas. Baty sought to establish an integrated theater, a synthesis of seven arts similar to the harmonious Communion of Saints. He subordinated all theatrical elements to the stage director who became as creative as the playwright-author. Baty sought to broaden the scope of theatrical subject-matter, to introduce a universe beyond reality upon the stage. An obstacle was the living actor and he considered that a better instrument to suggest unreality was the marionette. He did not, however, recommend the elimination of the living actor. Each had its proper role to fulfill.

All his life Baty had to counter the accusation that he was an enemy of the literary text of drama. The legend had started with his essay *Sire le Mot*. In later years Baty insisted that the text was supreme. In collaboration with Jean-Jacques Bernard he was called a representative of a Theory of Silence. Baty preferred to commend a Theater of the Unexpressed.

Part Three compares Baty with the other members of the Cartel. The Appendices include original correspondence between Baty and Jacques Hébertot, sources of *Crime et châtiment* and extracts from the rare prompt-book of that play.

314 pages. \$3.93. Mic 55-155

ZOOLOGY

**THE ELECTRON MICROSCOPY
OF *TRICHOMONAS MURIS***

(Publication No. 12,095)

Everett Anderson, Ph.D.
State University of Iowa, 1955

Chairman: Assistant Professor L. H. Saxe

Thin sections of *Trichomonas muris*, from the caecum of *Mesocricetus auratus*, were observed with the aid of the electron microscope to determine the structural details of organelles of this species.

The blepharoplast appeared to be limited by a membrane. What seem to be basal granules occur in the blepharoplastic area and measure approximately 500 Å in diameter. Separate granules were seen for the parabasal body, axostyle, costa and the lamellae of the undulating membrane.

In cross section the anterior flagella and posterior flagellum are composed of eleven fibrils, two centrally and nine peripherally located. Each fibril measures about 380 Å in diameter.

The so-called "accessory filament" of the undulating membrane is devoid of any filamentous structure and appears to be composed of two differentiated

meshwork areas. The undulating membrane is composed of a series of lamellae ranging from 300 to 400 Å in thickness. This organelle is attached to the external body surface by fine fibers ranging from 167 to 300 Å in thickness.

The costa consists of a series of disks embedded in a matrix. The costa is attached to the internal body surface by what appear to be extensions of the costal disks. These disks are approximately 370 Å in thickness and spaced 490 Å apart.

The axostyle is limited by a double, corrugated membrane. These corrugations are about 150 Å in thickness and spaced 110 Å apart. The axostylar contents (endoaxostylarplasm) in some instances show a different pattern from that of the surrounding cytoplasm. The so-called chromatic ring is composed of a series of rods approximately 640 Å in thickness.

The parabasal body consists of a series of filamentous strands and tubules approximately 190 Å in thickness. The parabasal filament is distinct from the parabasal body and measures about 580 Å in thickness.

Mitochondria, spheroidal in shape, are limited by a membrane about 180 Å in thickness. The internal structure consists of a varying number of projections which make this organelle appear in section as a series of compartments.

Chromatic granules (paracostal, para-axostylar, endoaxostylar and those scattered in the cytoplasm) are irregular in shape and limited by a membrane approximately 200 Å in thickness. These granules typically display a vacuolated internal structure.

70 pages. \$1.00. MicA 55-1530

STUDIES OF SMALL MAMMALS ON ABANDONED FARM LAND IN SOUTHCENTRAL NEW YORK

(Publication No. 12,275)

Kile Ray Barbehenn, Ph.D.
Cornell University, 1955

Many conspicuous gaps in our knowledge of the detailed ecological life history of the meadow mouse (*Microtus pennsylvanicus*) exist. A broad study aimed at several related problems was begun in the spring of 1952 at Ithaca, New York. Emphasis was gradually focused on three aspects of the research:

1. the ecological distribution and relative abundance of small mammals on abandoned farm land;
2. the interrelationships between *Microtus* and the short-tailed shrew (*Blarina brevicauda*); and,
3. the growth rate of *Microtus* in the field.

Relative population estimates of small mammals were obtained by establishing 22 permanent census lines transecting a wide variety of old-field and abandoned hay and pasture types. These lines were snap-trapped in the summer of 1952 and in the spring and fall of 1953 and 1954. Over 1800 specimens of 12 kinds of small mammals were collected here.

Results of these censuses served primarily to demonstrate the high degree of variability in apparent

population densities between seasons and years on the same areas, and between areas in the same season. These facts, coupled with the high degree of adaptability for various microhabitats by most species dictated against a statistical analysis of habitat "preferences." The low value of the method in studying population dynamics was stressed.

Analysis of the above snap-trapping suggested that *Microtus* and *Blarina* were randomly associated where they occurred together in a habitat. However, observations of scats and captures with a grid of live-traps in an intensively studied 12-acre field in 1953 suggested that there was a strong tendency for individual trapping stations to record either pure *Microtus* or pure *Blarina* activity. Severe disturbance to the *Blarina* population by the traps precluded a detailed analysis of these data, so, in 1954, a grid of 200 milk-carton bait boxes were placed in this field. These were checked daily for bait removal and scat deposition for periods of 10-plus days in June, July, and August, 4 days in September and 5 days in October.

These methods gave a measure of the progressive increase in activity of *Sorex cinereus* and *Blarina* in the area. An unexplained 25% decrease in *Microtus* activity took place between July and August. Differential seasonal microhabitat preferences were apparent, but no marked interspecific relationships were indicated by scat activity at stations within and between months.

Selective live-trapping to avoid *Blarina* was done in the first three months, and the area was thoroughly snap-trapped in September and October. This snap-trapping provided a comparison between the actual population structure of *Microtus* and that indicated by the live-traps. It also served as a partial check on the validity of using scats at bait stations as an indication of the distribution and relative abundance of the various species.

Growth rate of *Microtus* was studied in two fields. Growth rates of juveniles varied from 0.2 to 0.5 grams per day during 3 to 4 week periods in the summers. Males born after mid-June did not reach puberty the same season; females did not reach puberty before 6 weeks. Males either lost weight or failed to grow between August and late November, 1953. Adult males weighed between 35 and 40 grams. Many males heavier than 40 grams in 1954 may have resulted from successful early spring breeding and a growth rate approximating that recorded by Hamilton. Differential growth and size of individuals was not readily attributed to soils, weather or forage composition.

The results have served more to define problems and to demonstrate the use of methods than to clarify any of the complex interrelationships between the meadow mouse and its environment.

102 pages. \$1.28. MicA 55-1531

THE MORPHOLOGY AND GROWTH OF AMBLYSTOMA CHIMERAS

(Publication No. 12,263)

Gilbert Church, Ph.D.
Stanford University, 1955

Amblystoma tigrinum and *A. punctatum* embryos were employed to produce chimeras in which the fusion, designed to test the growth dominance reported by Stone (1) of the anterior over the posterior component, were made at levels from in front of the gills to behind the anus.

The results differ significantly from those obtained by Stone. Except for slight regulation at the line of fusion, necessary for the connection of the two unequally proportioned parts, in no instance did the anterior component exert a significant effect on the size of the posterior part. Each part consistently maintained up to metamorphosis a size and hereditary pattern characteristic of its species irrespective of the level at which the union was made.

Some evidence was obtained which showed that partial size adjustment in the posterior part did occur after metamorphosis in chimeras in which the union of the two components was in the trunk region.

Tissue incompatibility was manifested at metamorphosis in chimeras composed of material from the Chicago area. Such was not the case with chimeras composed of material from Tennessee; some of these lived for two years.

It is concluded that chimeras composed of *A. tigrinum* and *punctatum* grow and develop up to metamorphosis in a manner comparable to single organ grafts between the two species, and lend themselves to similar analytical study and interpretation.

86 pages. \$1.08. MicA 55-1532

1. Stone, L. S., Production and metamorphosis of chimeras in anurans and urodeles. *Proc. Soc. Exp. Biol. and Med.* 31:1084. 1934.

BODY WEIGHT, CELL SURFACE AND METABOLIC RATE IN ANURAN AMPHIBIA

(Publication No. 11,971)

John Amerpohl Davison, Ph.D.
University of Minnesota, 1955

Concepts, originally derived from observations on mammalian body size-metabolic rate phenomena were criticized. Early interpretations involved a consideration of heat loss as a regulatory mechanism of control of heat production. Since cold-blooded animals do not maintain an elevated body temperature, a consideration of cell surface was adopted as a point of attack on the general problem. In addition, certain published information has implicated the central nervous system in a directive role with respect to whole animal metabolic performance.

Methods were presented for the quantitative

measurement of a) metabolic rate, b) intact neural performance (buccopharyngeal frequency) and c) cell surface concentration of homologous skeletal muscles in 6 species of frogs. The animals ranged in body weight from 0.1 gm (immature *Pseudacris nigricans*) to 400 gms. (adult *Rana catesbeiana*).

Since metabolic rate ($\text{ccO}_2/\text{hr/gm}$ and muscle surface concentration (cm^2/cm^3 fibers) each varied as $W^{-\frac{1}{3}}$, surface concentration and metabolic rate remained directly proportional for each species considered separately. In the three *Rana* species, buccopharyngeal frequency was found to be a species constant independent of body weight intra-specifically. Postulating a neurally stimulated *in vivo* muscle respiration rate, a simultaneous treatment of a) neural activity and b) muscle surface concentration was proposed as a mechanism of control of the respiratory rate in the intact frog. Assuming a respiratory system dependent on the cell surface, and an all-or-none stimulation of this system by the central nervous system, the best quantitative approximation of whole animal metabolic performance was given by the product of a) buccopharyngeal frequency and b) muscle surface concentration.

The significance of the neuro-muscular complex was discussed with respect to information in the literature concerned with temperature and metabolic rate and metabolic rate of excised tissues.

Based on published metabolism findings, cell surface was demonstrated to indicate changes coincident in time and direction to metabolic rate changes during the entire ontogeny of the frog from the egg to the adult animal.

54 pages. \$1.00. MicA 55-1533

STUDIES IN THE BIOLOGY, ECOLOGY AND CONTROL OF THE PEACH LEAF-MINER, PHYTOMYZA PERSICAE FRICK (ORDER DIPTERA, FAMILY AGROMYZIDAE)

(Publication No. 12,019)

Alfred Clinton Dowdy, Ph.D.
The Ohio State University, 1954

Adviser: Alvah Peterson

Studies involving biological, ecological and control investigations of the peach leaf-miner were conducted during the spring and summer months of 1952 and 1953. Laboratory and field investigations were conducted at Wooster, though most of the experimental data were obtained in the infested Hodges Orchard near Berlin Heights, Ohio.

The species which had previously been known as *Phytomyza obscurella* var. *nigritella* was declared a new species by the American authority on Agromyzids, K. E. Frick, and in 1954 was described as *Phytomyza persicae* Frick. Type material used for this description was furnished by the author.

Areas outside Ohio where the miner was reportedly found are as follows: Pennsylvania (Arendtsville),

New Jersey (Evesboro), Michigan (Shelby), West Virginia, Maryland, and Ontario, Canada. In Ohio light infestations were found in Wayne, Franklin, Belmont, and Columbiana counties. Heaviest infestations were found near Berlin Heights, Erie County.

In 1953 approximately seven per cent of the foliage was mined in the experimental orchard. Individual trees ranged from having none to over 50 per cent of their leaves mined. The low center area of trees was over twice as heavily mined as were other areas.

The miner was found to attack peach, sour and sweet cherry, and plum trees naturally. Wild black cherry trees were infested artificially. Mining appeared to cause considerable defoliation on cherry trees while little or none occurred on peaches.

Both internal and external parasites were found to attack miner larvae. Five species of internal parasites and eleven external ones were identified. *Halticoptera aenae*, an internal species was the most abundant parasite found. DDT sprays applied by the orchardist were thought to be a limiting factor on parasite numbers.

The more important conclusions derived from various life history and ecological investigations are as follows:

1. Male and female flies occur in approximately equal numbers. Mating, which may last for over 1/2 hour, often takes place within 24 hours after emergence. The female may lay 27 or more eggs. Adult activity, including short rapid flight, is more pronounced on warm sunny days. Most adults apparently die within six days after emergence.

2. The time interval between egg-laying and the appearance of mines (incubation period) is dependent upon ecological factors. An average figure during warm weather is eight days. First instar larvae are found in small blotch type mines or linear mines up to 3/4 cm. long; second instar larvae in mines ranging from small blotches up to 3 cm. long; and third instar larvae in mines ranging from 3/4 cm. to over 5 cm. long. Puparia are normally found at the ends of completed mines where anterior spiracular processes are inserted through the upper epidermis of the leaf.

3. In 1952 three complete generations occurred, while a partial fourth appeared in 1953. The timing of the orchardist's DDT sprays may have been the major factor contributing to the occurrence of only three generations in 1952.

Parathion, EPN, demeton, and dieldrin were found to be highly effective in the control of adults. DDT was found to be slower than these materials in effecting knockdown. In general, the phosphate insecticides (parathion, EPN, demeton, malathion) gave good control of larvae within mines while others did not. No insecticide tested was effective against insects within puparia.

134 pages. \$1.68. MicA 55-1534

A REVISION OF THE NEW WORLD SPECIES OF POWDER POST BEETLES BELONGING TO THE FAMILY LYCTIDAE

(Publication No. 11,883)

Eugene Jordan Gerberg, Ph.D.
University of Maryland, 1954

Supervisor: Dr. William E. Bickley

Members of the coleopterous family Lyctidae can be characterized as small brownish beetles with eleven-segmented antennae with a club of two (rarely three) segments, and pentamerous tarsi. They are world wide in distribution, though predominant in the tropical and temperate zones. The larvae are xylophagous and are of prime importance among insects as destroyers of wood and wood products.

Adequate keys to the genera and species have been lacking. A key to the genera of the Lyctidae of the world is presented. A checklist of the world fauna lists 12 genera and 64 species. Lesne in 1938, catalogues 12 genera and 63 species. Two of the species listed in his catalogue have been placed in synonymy. Two species that were described after 1938 have been added. One of these species proved to be a primary homonym and a new name has been proposed for this species. One new species from Chile is described.

The history of the classification of the family, from 1762 to the present is annotated. The biology, economic importance and control measures are reviewed. The external morphology of the Lyctids is discussed and illustrations of the ventral and dorsal aspect of an adult Lyctid are provided. The male and female genitalia of all available species were dissected, studied, and the male genitalia illustrated. The genitalia proved to be of limited taxonomic value.

The genera *Lyctus* Fabricius, *Minthea* Pascoe, *Lyctoxylon* Reitter, *Trogoxylon* LeConte and *Phyllyctus* Lesne are discussed, and keys to the species reported from the New World are provided. Each of the 29 species reported from the New World is re-described and 23 species are illustrated with 171 figures.

There are 188 references listed.

141 pages. \$1.76. MicA 55-1535

STUDIES ON THE CONTRACTION OF FROZEN-DRIED MUSCLE

(Publication No. 11,563)

Amos Lawrence Hopkins, Jr., Ph.D.
Washington University, 1955

Chairman: Viktor Hamburger

The contraction produced when frozen-dried muscle fibers are rehydrated has been investigated. The results were briefly as follows. The per cent shortening of this preparation amounts to 60-70% of the original length of the fibers. Under conditions of isotonic contraction, the preparation is able to do

100 g.cm. of work per gram of living muscle. Under isometric conditions, a tension of 9-12 g./mm is developed. Contraction is preceded by an initial relaxation and is complete within 10 to 15 seconds. A second contraction can be produced by ATP, but the frozen-dried muscle lacks the sensitivity to ATP that is exhibited by glycerinated preparations. The sensitivity can be increased by previous exposure to 50% glycerol solution. It is concluded that the process of freezing and drying does not destroy the contractile system of muscle and that the behavior of such preparations bears more resemblance to that of living muscle than does that of any other so far described.

The amount of shortening of the frozen-dried fibers, their ability to do work, the maximum tension that they can develop, and the effect of temperature on these processes all demonstrate that the contractile system of living muscle is not destroyed by freezing and drying. The contraction produced by the rehydration of frozen-dried muscle is much like that of living muscle except that the rate of contraction is much slower.

The usefulness of the frozen-dried muscle preparation to the study of the physiology of muscular contraction depends on the particular aspect of the subject being studied. The low sensitivity of the frozen-dried muscle to ATP, and the fact that this can be overcome, indicates that the preparation may be useful in studying the mechanism that keeps ATP and actomyosin from reacting in resting muscle. It has the further advantage of being the only muscle preparation that offers the possibility of studying the initial event in contraction, or at least a process which closely related to it. It is the only preparation that retains such a high degree of structural integrity while retaining much of its normal physiological behavior.

53 pages. \$1.00. MicA 55-1536

WINTER MICROCLIMATES OF IMPORTANCE TO ALASKAN SMALL MAMMALS AND BIRDS

(Publication No. 9756)

Harry McClure Johnson, Ph.D.
Cornell University, 1954

Winter microclimatic conditions at areas in the continental interior of Alaska, particularly near Fairbanks, Alaska, and at areas on the Arctic Slope of Alaska were measured and observed during the 1950-1951 and 1951-1952 winter periods.

The microclimatic and macroclimatic conditions, consisting of changing fields and distributions of quantities, were approximately determined in the continental interior for a variety of habitat types at areas of valley lowland, adjoining hills, small depressions, and the Chena River channel. The determination of temperature fields was emphasized.

The microclimatic and macroclimatic conditions were approximately determined for a variety of microclimatic and macroclimatic states and events in

the several main microclimatic zones. The environmental events primarily studied were: a) cold-snaps, b) midwinter warm periods (storms), c) periods of rapid warming, d) periods of rapid cooling, e) periods of regular diurnal variation, and f) late winter cold periods. The main microclimatic zones were: a) the upper layers of the lower atmosphere, b) the lower layers of air, c) the upper surface of the snow-cover and the layers of air and snow respectively just above and below it, and d) the ground surface and the layers of air (and snow) and soil respectively just above and below it.

Concurrent with the determinations of conditions of the physical environment observations were made concerning animal activity and the biotic environment. The animals chiefly studied were the small mammals: *Clethrionomys rutilus*, *Microtus oeconomus*, *Tamiasciurus hudsonicus*, *Mustela erminea*, *Sorex cinereus*, and *Lepus americanus*; and the birds: *Acanthis* sp., *Parus atricapillus*, *Corvus corax*, and *Pedioecetes phasianellus*. These animals, and others, comprised groups corresponding to the four main microclimatic zones.

An attempt was made to determine the response of these animals to conditions in the several zones during the principal microclimatic states and events. In general, the animals of all zones avoided the most severe conditions of the coldest zones (the snow surface zones) during the coldest events (cold-snaps) by retreating to warmer, more favorable zones (such as the subnivean zones). The animals tended to be considerably more active in the snow surface zones at the generally warmer areas up on hills than at the colder lowland areas. They were also considerably more active in the surface zones during the generally warmer conditions of late winter.

The subnivean small mammals were dependent for survival upon the continuous existence of the warm subnivean microclimates. Temperatures in the warmest subnivean zones were commonly 20 to 25°F even during cold-snaps. Temperature differences across a snow-cover two feet in depth were observed to be as much as 90 to 100°F in a small depression "cold pocket" during an intense cold-snap. During warmer periods subnivean temperatures were commonly 25 to 30°F.

The small birds at times fed on seeds on the cold snow surface when it had temperatures of -60° to -70°F. During such conditions they exhibited special (adaptive) behavior.

Relatively warm and cold microclimatic zones were also found at areas on the Arctic Slope and on the Arctic Coast. There the environmental conditions were quite different from those of the continental interior of Alaska. There too small mammals utilized the protection of the warmer microclimates of certain subnivean zones.

139 pages. \$1.74. MicA 55-1537

BLOOD CHEMISTRY AND LARVAL
MIGRATION STUDIES IN
TRICHINIZED RABBITS

(Publication No. 12,110)

Chris Sullivan Jordan, Ph.D.
State University of Iowa, 1955

Chairman: Professor L. O. Nolf

This investigation was done so that a better understanding of the early phases of trichinosis might be obtained and made applicable to the early diagnosis and treatment of this malady in man.

Twelve rabbits were infected with Trichinella spiralis and then at varying intervals of time over a period of fifty-four days, blood samples were drawn and a series of chemical tests were performed on the sera. A comparison was made between the results of the tests from the twelve trichinized rabbits with an equal number of control animals. Sixteen more rabbits were infected with T. spiralis and observations were made over a period of ninety days on the larval migration in various tissues and organs.

With a light to moderate infective dosage of T. spiralis ranging up to seven larvae per gram of body weight, rabbits show very little variation from the normal values in their serum levels of sodium, potassium, calcium, chloride, glucose, total proteins, and albumin-globulin ratio as measured by routine clinical laboratory tests.

Encysted trichinae are probably never found in such organs as the heart, liver, kidney, spleen, lung, and brain of the rabbit. The infrequent finding of larvae within the circulatory system together with the presence of numerous new-born larvae free within the body cavities of infected rabbits during the migratory phase of the worms lends support to the concept that some of the larvae may migrate to the striated muscle tissues directly along the fascial planes.

37 pages. \$1.00. MicA 55-1538

OBSERVATIONS OF THE ENTERIC
PROTOZOA OF Rana pipiens DURING
LARVAL DEVELOPMENT AND
METAMORPHOSIS

(Publication No. 12,112)

William Henry McArthur, Ph.D.
State University of Iowa, 1955

Chairman: Assistant Professor L. H. Saxe

The alimentary tracts of over 500 Rana pipiens tadpoles and frogs were examined for protozoa, and the occurrence of parasites was correlated with the developmental stages of the hosts.

Hosts were secured from seven ponds located in the vicinity of the Iowa Lakeside Laboratory in Dickinson County, Iowa. Mastigina hylae, Chilomastix sp., Trichomonas augusta, Opalina obtrigonoidea and Nyctotherus cordiformis were found in hosts collected from each of the seven ponds. Other species were less widely distributed. Giardia agilis was found in tadpoles from only two ponds. Euglenamorpha and Endolimax were found in hosts from only one pond.

Protozoa most commonly found in Rana pipiens tadpoles were Opalina obtrigonoidea and Nyctotherus cordiformis. Common organisms (i.e. those found in almost every developmental stage) were Mastigina hylae, Chilomastix sp., Trichomonas batrachorum, Trichomonas augusta, Hexamitus intestinalis, Octomastix sp. and Entamoeba ranarum. Less common species were Euglenamorpha hegneri, Monocercomonoides sp., Urophagus sp. and Octomitus sp.: species rarely encountered were Giardia agilis and Endolimax ranarum.

Organisms which most frequently survived metamorphosis were Trichomonas batrachorum, T. augusta, Hexamitus, Octomastix, Entamoeba, Opalina and Nyctotherus. Protozoa not found to survive metamorphosis were Euglenamorpha, Mastigina, Chilomastix sp., Octomitus, Giardia and Endolimax.

Euglenamorpha, Trichomonas batrachorum, T. augusta, Hexamitus, Octomastix and Nyctotherus are not host-specific for Rana pipiens. The preceding protozoa were successfully transfaunated to Xenopus laevis tadpoles. 41 pages. \$1.00. MicA 55-1539

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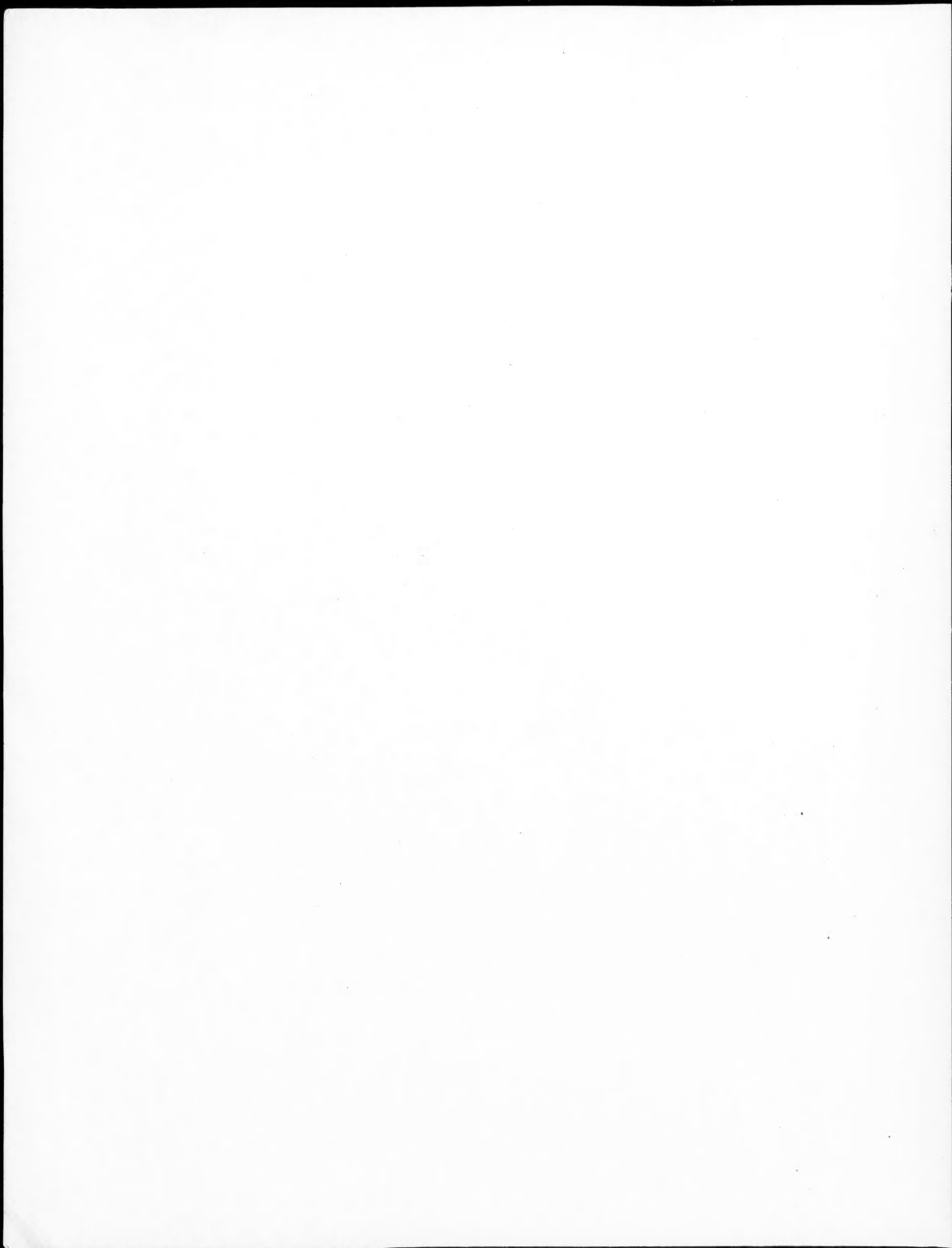
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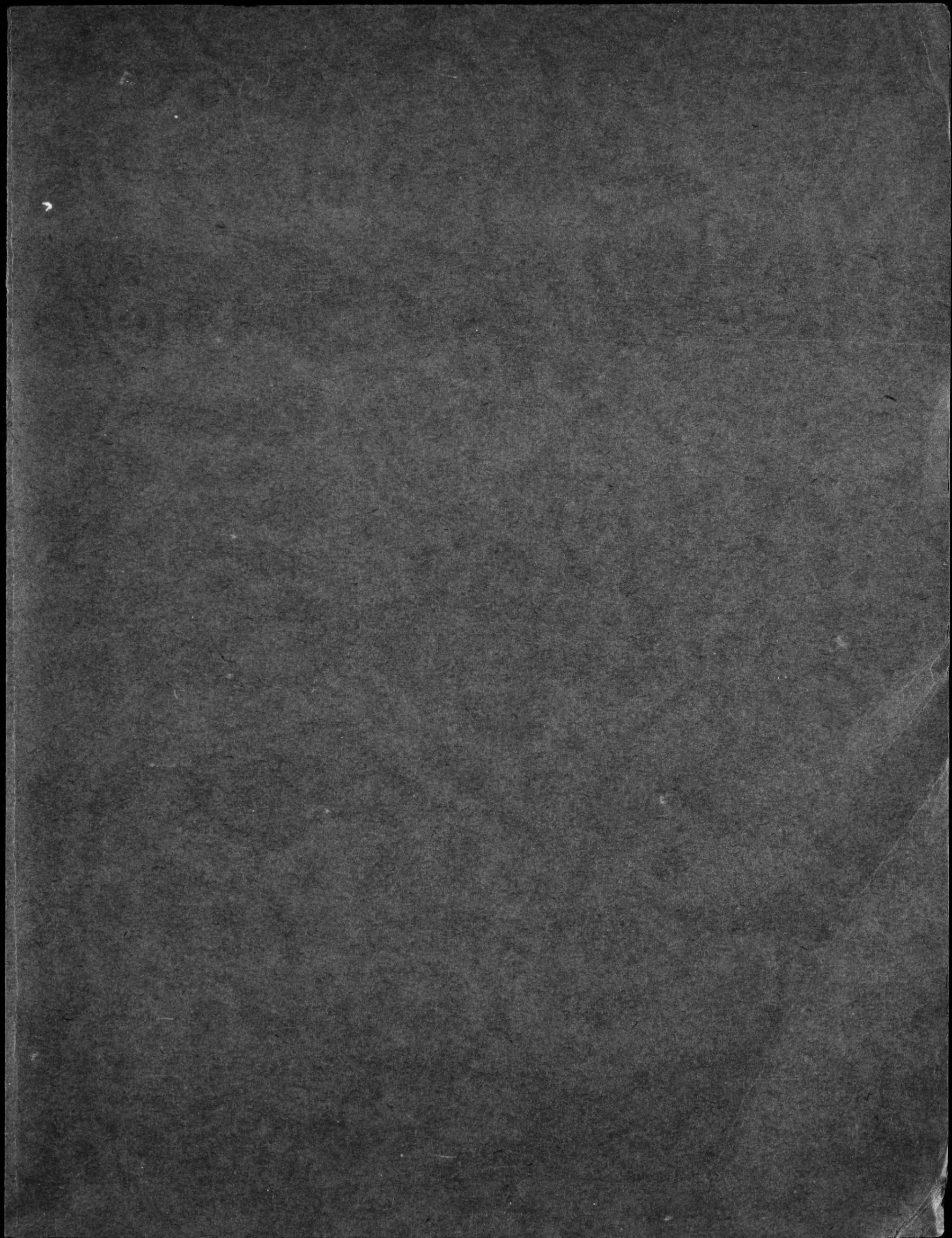
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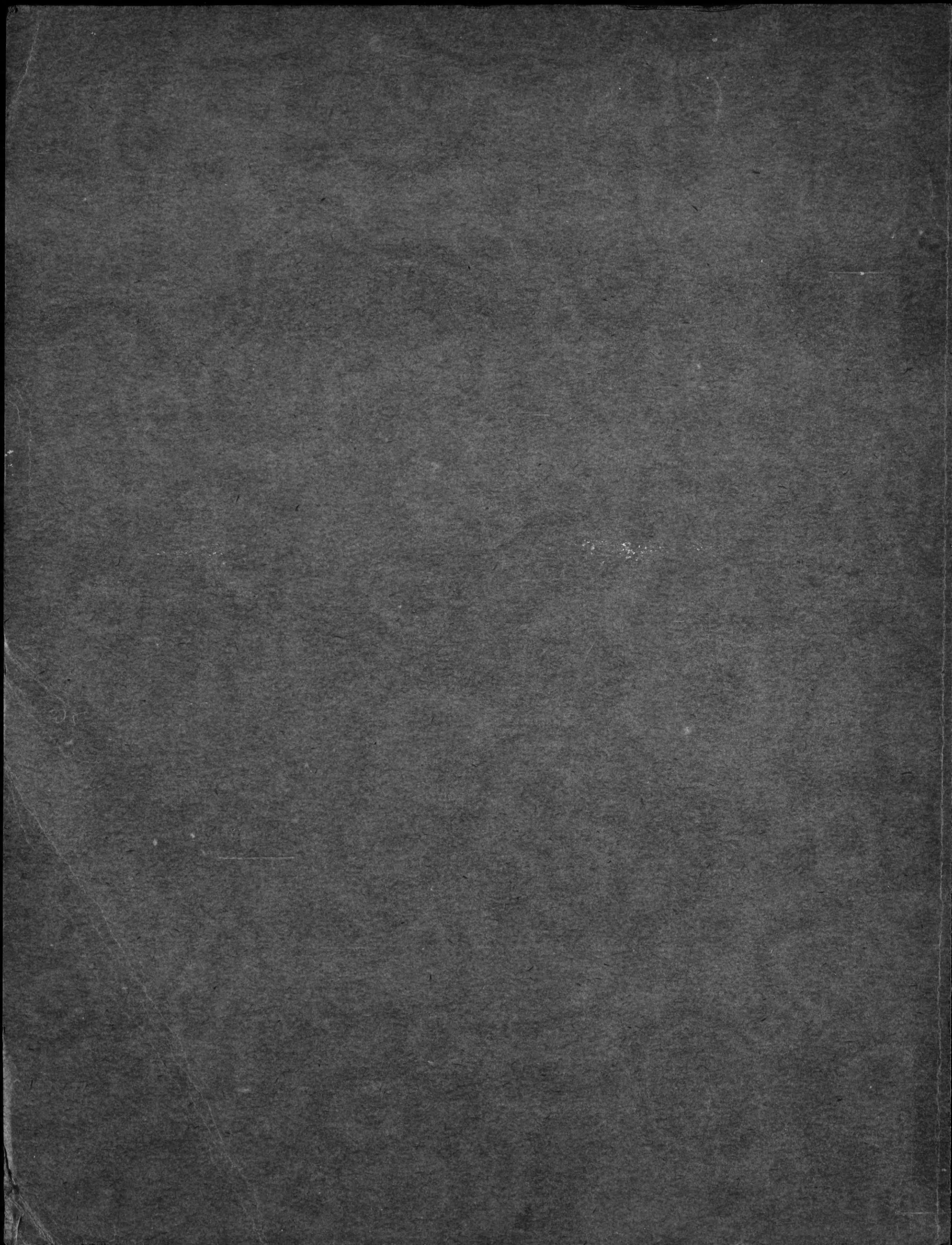
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